



COMMONWEALTH of VIRGINIA

Office of the Governor

Timothy M. Kaine
Governor

May 11, 2007

Ms. Cardella Mingo
National Governors Association
Center for Best Practices
444 North Capitol Street, Suite 267
Washington, DC 20001-1512

Dear Ms. Mingo:

In Virginia, we have worked hard to become a national leader in education quality and accountability. Over the last few years, we have seen marked improvements in our schools and in our children's performance. The standards we have set have helped us offer high-quality public education throughout the state. Nationally, we have met and exceeded performance expectations.

However, I have come to realize that being a national leader is not enough. In a global market, where knowledge is quickly becoming our currency, we must continue our aggressive efforts to build a world-class system in Virginia from pre-kindergarten to higher education. Our future progress depends upon it.

A generation ago, a college education was not a requirement for a comfortable, middle-class life. Today, some postsecondary education is critical to finding opportunities in the modern job market. It is our duty to help Virginia's students understand the value of career paths that are in high demand in the 21st century and to give them all the support we can to prepare them for those high-skill, high-wage jobs. My goal is to shift the focus of our education system from competence to excellence in order to help our students succeed in school and in life.

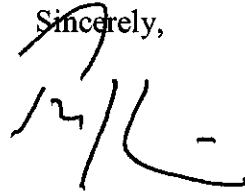
We have made several positive strides toward addressing 21st century workforce needs. Virginia has been an active participant in the State Scholars initiative, with 11 pilot divisions completing their first year in the program. Additionally, this year we have seen the number of high school students receiving industry credentials nearly double, in large part due to support from the General Assembly. During the 2007 legislative session, the General Assembly passed a bill requiring the Board of Education to develop criteria for a Technical Diploma, which I later amended to include an Advanced Technical Diploma.

Ms. Cardella Mingo
May 11, 2007
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While I'm proud of the work we have done for career and technical education, we still have a long way to go. I have heard again and again from CEOs of the top businesses in Virginia that there are not enough skilled workers to meet their increasing needs. It is our responsibility to elevate career and technical education to help students, parents, and the public understand that without a qualified, highly skilled workforce, we will not be able to compete with other advanced nations. It is our duty to help Virginia's students understand the value of career paths that are in high demand in the 21st Century.

It is essential that we develop new and creative ways to meet 21st century workforce needs and to help our students succeed. This proposal gives students opportunities to excel in career and technical fields and changes the perception of career and technical education in the Commonwealth.

Sincerely,

A handwritten signature in black ink, appearing to read 'TMK', with a horizontal line extending from the end.

Timothy M. Kaine

TMK/jpm
Enclosure

VIRGINIA'S PROPOSAL
TO THE
NATIONAL GOVERNORS ASSOCIATION

SCIENCE, TECHNOLOGY, ENGINEERING AND
MATH CENTER GRANT PROGRAM



MAY 15, 2007
GOVERNOR TIMOTHY M. KAINE

Contact: Judy Heiman, Deputy Secretary of Education
judy.heiman@governor.virginia.gov, (804) 692-2546

**Virginia's Proposal
to the National Governors Association
Science, Technology, Engineering and Math Center Grant Program**

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Virginia's Proposal to the National Governors Association Science, Technology, Engineering and Math Center Grant Program

Overview

Virginia has targeted its STEM Center proposal to the NGA toward development of model programs in career and technical education (CTE). These programs will expand options for *the general population of students* to acquire STEM literacy and other critical knowledge, skills and credentials that will prepare them for high-demand, high-wage and high-skill careers in Virginia.

Virginia has excelled at developing programs for gifted and talented students through outstanding Governor's Schools, specialty centers and various acceleration and enrichment programs. We have also done a good job of producing and attracting college-educated scientists, engineers and other knowledge workers. However, we have fallen short in developing critical 21st Century skills in the general student population. We will not be able to meet the needs of Virginia's current and emerging industries without raising the educational achievement and attainment of this middle majority. We have identified CTE as a promising avenue for developing these skills through applied learning in a relevant context, closely tied to Virginia's business needs and economic development objectives.

Specifically, we propose to work with state policy-makers, local school divisions, local government including regional workforce and economic development officials, industry partners, community colleges and universities to:

- ◆ Create several **Governor's Academies for Career and Technical Education**, which will be the applied learning complement to Virginia's successful Governor's School program. These will be Virginia's new STEM Centers. Academies will offer career pathways addressing both immediate regional skill gaps and longer-term STEM-related strategic gaps, as identified in Virginia's Gap Analysis (Attachment A – Part A). Through high standards, recognition, acceleration options and industry and higher education partnerships, these programs will directly challenge current belief structures about career and technical education. They will serve as model programs for the transformation of CTE throughout Virginia and the nation.
- ◆ Establish a high standard for all CTE programs through a **Governor's Exemplary Standards Award program**. This will be a continuous quality improvement process engaging K-12 and higher education, the business community and state, regional and local officials. The opportunity to earn this distinction will create an incentive for programs to meet high academic standards and improve other measures of program quality, strengthen their partnerships and alignment with postsecondary education and industry, and demonstrate relevant and positive outcomes. Programs earning this distinction will form a growing network of exemplary programs to share best practices with each other and with other programs striving for the designation. All CTE programs will be eligible to seek exemplary status. The criteria for the awards will ensure that all programs earning exemplary status will raise the STEM literacy of participating students through rigorous academic and programmatic standards.

Commitments/Non-negotiables

1. **Commitment to NGA Graduation Rate Compact.** Governor Tim Kaine has reaffirmed Virginia's commitment to accurate and meaningful reporting of high school graduation data by signing the NGA Graduation Rate Compact. In 2005 Virginia implemented a unique identifier in its Educational Information Management System to permit longitudinal tracking of student data. Data collection has proceeded, and we will report the first four-year graduation rate data for the Class of 2008. Efforts are underway to create a virtual P-16 data system by linking existing longitudinal systems across the educational pipeline.
2. **Commitment to actively participate in the National Educational Data Partnership.** Virginia actively participates in the National Education Data Partnership initiative and was one of the first states to provide complete data for Standard & Poor's (S&P) SchoolMatters.com. The Department provides a link to SchoolMatters.com on its home page, and uses these data sources to make national comparisons about student achievement.

3. ***Commitment to create and execute a communications plan.*** The Secretary of Education has appointed a communications work group of the P-16 Education Council to oversee development and implementation of an executive communication plan for Virginia's high school reform. This group will continue its work and adapt the current plan to build and sustain public support for STEM education redesign and improvement.
4. ***Commitment to an aligned P-16 governance structure.*** Virginia's P-16 Education Council was created by executive order in 2005 and renewed in 2006. In the executive order renewing the council, Governor Kaine announced his intention to submit legislation to the 2008 General Assembly to make the council permanent. The council is chaired by the Governor's Secretary of Education and includes executive-level representation from the Board and Department of Education, the State Board for Community Colleges and the Virginia Community College System, the State Council of Higher Education at the board and staff level, public and independent higher education institutions, state and local elected officials, business leaders, the Virginia Education Association, the National Science Foundation, and additional state agencies. Information about the Council and its responsibilities, as well as its first report and recommendations, are available on the Secretary's web page at <http://www.education.virginia.gov/Initiatives/P-16Council/index.cfm>.
5. ***Commitment to set specific 10-year performance goals.*** As part of its Honor States grant commitment, Virginia has been working to develop 10-year performance goals with direct and supporting indicators for high school graduation and college and workplace readiness. A draft of the 10-year goals has been finalized and shared with NGA staff, and is scheduled for consideration by the P-16 Education Council at an upcoming meeting. The P-16 Council will expand upon these goals to include more STEM-related indicators in consultation with NGA staff. By securing approval of the goals from the P-16 Council, we will ensure that all education agencies and boards have signed on to these priorities.
6. ***Commitment to publicly report the objectives of the STEM Center Grant and the identified 10-year goals along with baseline and improvement data.*** Through Virginia's P-16 Education Council, we will report on the objectives, goals and results of the STEM Center Grant. Communication will include development of a grant Web page on the Governor's site, information on the Web sites of participating agencies and offices, formal reports to the Governor and General Assembly, and presentations to stakeholder groups, as well as any reporting requested by the NGA and funders.

A. Gap Analysis of Virginia's Policy Landscape

Please see Attachment A.

B. Team Leadership and Membership

Team Leader: Tom Morris, Virginia's Secretary of Education, is the team leader for this initiative. Secretary Morris was appointed by Governor Kaine in 2006 to lead his education agenda. One of the Governor's key education goals is to raise the quality and profile of career and technical education, and Secretary Morris' leadership of the STEM Center project will directly advance this component of the Governor's agenda. Prior to his appointment within the Governor's Cabinet, Secretary Morris served as the president of Emory & Henry College for 13½ years. A distinguished Constitutional scholar and political scientist, he was a distinguished faculty member at the University of Richmond for 21 years, and is widely known as an expert on Virginia government and politics. Dr. Morris chairs Virginia's P-16 Education Council, and works closely with the agencies and boards in the Education Secretariat including the Department and Board of Education, the Community College System, the State Council of Higher Education, and public and independent colleges.

Co-leadership will be provided by Dr. Billy K. Cannaday, Jr., Superintendent of Public Instruction, Chancellor Glenn DuBois of the Virginia Community College System, and Executive Director Daniel LaVista of the State Council of Higher Education for Virginia, who are also members of the P-16 Council. These individuals will provide leadership in the K-12 and higher education communities to ensure close coordination among educational sectors in implementation of the project.

STEM Center Design Team

Governor's Office and Advisors

- ◆ Dr. Thomas R. Morris, Secretary of Education*
- ◆ Mr. Patrick O. Gottschalk, Secretary of Commerce and Trade*
- ◆ Mr. Daniel G. LeBlanc, Senior Advisor to the Governor for Workforce*
- ◆ Ms. Judith E. Heiman, Deputy Secretary of Education
- ◆ Mr. Douglas Garcia, Assistant Secretary of Education
- ◆ Ms. Jean Bankos, Senior Advisor to the Governor on Education Projects
- ◆ Ms. Jennie P. Moline, Special Assistant to the Governor for Policy

Virginia Department of Education

- ◆ Dr. Billy K. Cannaday, Jr., Superintendent of Public Instruction*
- ◆ Dr. Linda M. Wallinger, Assistant Superintendent for Instruction
- ◆ Ms. Elizabeth M. Russell, Director of Career and Technical Education

State Council of Higher Education for Virginia

- ◆ Dr. Daniel J. LaVista, Executive Director*

Virginia Community College System

- ◆ Dr. Glenn DuBois, Chancellor*
- ◆ Dr. Monty Sullivan, Vice Chancellor for Academic Services
- ◆ Mr. Peter Blake, Vice Chancellor for Workforce Development Services
- ◆ Ms. M. Elizabeth Creamer, Director of Postsecondary Perkins Tech-Prep

Local Education Agencies and CTE Educators

- ◆ Dr. Patrick Konopnicki, Director of Technical & Career Education, Virginia Beach Schools*
- ◆ Mr. Darah Bonham, Director, Charlottesville-Albemarle Technical Education Center (regional)*
- ◆ Ms. Sandy Jones, President, Virginia Association for Career and Technical Education*

Business and Industry

- ◆ Mr. John O. (Dubby) Wynne, Vice-Chairman, Council for Virginia's Future, and retired President and CEO, current Board member, Landmark Communications, Inc.*
- ◆ Ms. Katherine Elam Busser, Senior Vice President, Capital One*
- ◆ Dr. James G. Batterson, Senior Aerospace Engineer and Deputy Director for Strategic Development, NASA Langley Research Center and Special Assistant on Loan to the Secretary of Education*
- ◆ Dr. Emily Richardson, President, Virginia Career Education Foundation*

Virginia General Assembly

- ◆ The Honorable Phillip Hamilton, member, Virginia House of Delegates and House Education and House Appropriations Committees*
- ◆ The Honorable Frank Wagner, member, Senate of Virginia and Senate Commerce and Labor Committee*
- ◆ The Honorable John A. Cosgrove, member, Virginia House of Delegates and House Science and Technology Committee, and Chairman, Joint Subcommittee Studying Science, Math, and Technology Education in the Commonwealth at the elementary, secondary, and undergraduate levels*

In addition, the team will work with the Virginia Biotechnology Association (VaBIO), Virginia Nanotechnology Initiative (VNI), Virginia Modeling, Analysis and Simulation Center (VMASC), Center for Innovative Technology (CIT), Virginia Manufacturers Association, and other industry, academic and government groups focused on leading and emerging industry clusters.

*Letters provided in Attachment D from highest-ranking official in agency. The Governor's support and commitment are described in the proposal cover letter.

C. Virginia's STEM education goals to be supported by STEM Center Grant

The overall goal of Virginia's STEM Center grant project is to reinvigorate career and technical education as an option for all students, with the same postsecondary pathways readiness expectations as for non-CTE students, particularly in training for high-demand, high-wage and high-skill occupations. (Recommendation #3, Strategy #4 in *Building a Science, Technology, Engineering and Math Agenda*.)

The STEM education goals to be supported by this project are:

1. Increase the readiness of high school graduates for college level work in STEM areas.
 - a. Increase the number of students successfully completing mathematics courses at the level of Algebra II or higher in high school.
 - b. Increase the number of students successfully completing a State Scholars Course of Study (includes increasing the number of students completing a physics course.)
 - c. Increase the number of students successfully completing college dual enrollment courses in high school.
2. Increase the readiness of high school graduates for other postsecondary pathways in STEM areas.
 - a. Increase the number of students successfully completing industry certifications, state licenses and NOCTI assessments in high school.
 - b. Increase the number of students successfully completing career and technical education concentrations in high school.
3. Increase public understanding and support for K-12 STEM education redesign as an integral part of improving high school graduation rates and supporting Virginia's innovation capacity.
 - a. Increase business financial support for career and technical education.
 - b. Increase legislative support for career and technical education

D. Structure of Virginia's STEM Center initiative

The primary structure for Virginia's initiative is the development of a network to leverage the separate activities of two or more existing STEM Centers in the state. However, our initiative will contain elements of all three posited structures for this grant.

- ◆ We will support the development of up to six Governor's Academies for Career and Technical Education as described in the Overview. These academies may be new centers developed in response to this project, or existing centers in which standards are raised and efforts are refocused to advance Virginia's STEM agenda. Partnerships with industry, higher education and regional workforce officials will be integral to the Academy model.
- ◆ We will create a Governor's Exemplary Standards Award program to raise the rigor and quality of career and technical education programs across the state. This will be a two-step process: programs will work with business advisory groups and postsecondary faculty to validate their attainment of rigorous standards, and then apply for the Governor's designation. Over time there will be a growing network of Governor's Exemplary Programs that share best practices with each other and with other programs striving for this designation.

E. Objectives

NGA Core Objectives

Virginia's implementation of the STEM Center grant will address the following two core objectives:

3. **Seek innovative new school, curricula, assessment and standards models in STEM education and bring successful models to scale.** The Governor's Academies and Exemplary Standards Awards Program are new school and standard models for STEM education, and both are eminently scalable. The criteria for both programs will encourage innovative curricular, assessment and professional development strategies.

- 5. Develop a public-private partnership in one or more regions of the state, between leading economic clusters; K-12 districts; postsecondary institutions; state, county and local government; and the general public – to redesign a region's K-16 STEM education system to support the regional economy's innovation capacity.** Partnerships with business, higher education and regional workforce officials are integral to both components of Virginia's proposal. In keeping with current efforts to redesign Virginia's workforce development system, we will leverage relationships with Workforce Investment Boards, industry advisory boards convened by Workforce Coordinators from community colleges, and Career Pathways/Tech Prep/Perkins Leadership Teams convened by community colleges and local school divisions, and use this opportunity to focus and strengthen those relationships as business-education partnerships serving the full spectrum of K-12 through postsecondary education. Partners will participate in planning and development of academies, validate CTE programs' attainment of exemplary standards before the programs can apply for state recognition. A coordinated approach with our workforce, economic development and education colleagues will reduce fragmentation and improve the alignment of the P-16 system with regional industry needs and state priorities.

Virginia's Specific Objectives

Below are the mission, goals and specific measurable objectives for Virginia's STEM Center initiative.

Mission

To provide expanded educational opportunities for secondary students to gain STEM literacy and other knowledge, skills and credentials that will prepare them for high-demand, high-wage and high-skill careers, through partnerships of business and industry, public schools, community colleges and universities, and government.

- Goal #1:** To maximize opportunities to prepare students for targeted careers, by breaking down barriers between traditional core academics and career and technical education; between high school and postsecondary education and training; and between education and the workplace.

Specific Measurable Objectives

- 1A. Improve academic achievement of CTE students.
- 1B. Increase utilization of dual enrollment courses.
- 1C. Provide workplace experiences for more students.

- Goal #2:** To raise student aspirations, attracting more students to postsecondary education in preparation for technical careers, especially targeting students who might otherwise have settled for a curriculum that did not prepare them well for postsecondary education or work.

Specific Measurable Objectives

- 2A. Increase high school graduation rates and reduce drop-out rates.
- 2B. Increase enrollment and retention in postsecondary education.
- 2C. Increase proportion of students completing a college and workplace ready curriculum in high school.
- 2D. Reduce the proportion of students requiring remediation in college.

- Goal #3:** To provide well trained workers to support the recruitment of new businesses and industries to the Commonwealth and to meet the workforce needs of existing business and industry.

Specific Measurable Objectives

- 3A. Increase number of industry certifications and other industry- and postsecondary-recognized credentials awarded to high school students.
- 3B. Increase the number of graduates employed in technical and high-skill careers.
- 3B. (Long-term) Increase enrollment in and completion of targeted career pathways at community colleges and senior colleges.

In pursuing these goals, Academies must provide CTE programs that are part of Career Pathways in strategically targeted industries identified for future regional and state growth (energy, electronics, aerospace, biotech, and

others), and current high-demand fields as specified by regional industry partners and supported by industry and occupational cluster analyses, as described in the Gap Analysis.

Specific activities for which funds are requested

Governor's Exemplary Standards Program – nominal planning costs will be covered with state funds, and will include costs of bringing together CTE administrators and instructors and higher education, workforce and industry advisers to develop the criteria for exemplary standards awards, based on the rubric developed by the National Dissemination Center for Career and Technical Education. An outline of evidence to demonstrate program quality, significance and effectiveness can be found in the description of the Standards program in Attachment C. Once the standards are finalized it will take approximately one academic year for programs to conduct their reviews and document their attainment of the standards. This process must occur program-area by program-area and it will take centers several years to complete reviews for all programs. It is a two-step process requiring industry-driven validation at the local/regional level followed by application to the state. It is anticipated that in the second year of the grant about 12 programs will qualify for this recognition. Funds are requested to support a portion of a project director at the Department of Education to coordinate the review process. Funds are also requested for incentive awards for successful applicants. Awards will include \$5,000 grants for programs to pursue continued improvement activities, a banner to display at the school with the Governor's Exemplary Standard Award designation, and other small incentives such as caps or polo shirts for lead teachers with recognition for the award.

Governor's Academies for Career and Technical Education – internal planning costs will be covered with state funds. Matching funds have been secured for five \$20,000 planning grants in year 1 for regional partnerships to develop their collaborative academy proposals. Grant funds are requested for one additional planning grant. Grant funds are also requested for two \$100,000 implementation grants (matching funds support the remaining four start-up grants) including coordination, recruitment, professional development, and marketing and communications. Funds are also requested to support a portion of a project director at the Department of Education to coordinate technical assistance and proposal review. Non-grant funds will support equipment and facilities costs for program start-up.

F. Two-Year Work Plan

Specific Activities and Timeline

A description of the proposed Governor's Exemplary Standards Program and Governor's Academies for Career and Technical Education is provided in Attachment C. Specific grant activities to implement these initiatives are presented in the table below. The italicized text in the first column represents the key recommendations addressed by each activity from *Building a Science, Technology, Engineering and Math Agenda*. The numbering is as follows:

1. Align state K–12 STEM standards and assessments with postsecondary and workforce expectations for what high school graduates know and can do.
 - a. States should focus on aligning standards and assessments with international benchmarks through state level participation in international assessments.
 - b. States should align K–12 STEM expectations with all postsecondary pathways.
2. Examine and increase the state's internal capacity to improve teaching and learning.
 - c. States should develop a communication strategy to engage the public in the urgency of improving STEM.
 - e. States should support promising new models of recruiting, preparing, certifying, compensating, and evaluating teachers in STEM content areas.
3. Identify best practices in STEM education and bring them to scale.
 - a. States should create and expand the availability of specialized STEM schools.
 - b. States should develop standards and assessments in technology and engineering as well as math and science.
 - d. States should develop standards for rigorous and relevant Career and Technical Education (CTE) programs that prepare students for STEM related occupations.

Month/ <i>Recomm.</i>	Grant Activities	Responsible Parties
July-Sep 2007 <i>Rec. 3d.</i>	1. Convene statewide advisory group to develop Governor's Exemplary Standards for CTE Programs, based on existing rubric from National Dissemination Center for CTE.	Secretary of Education (SOE) & staff responsible and will include Department of Education (DOE) staff, incl. Office of CTE, local school division CTE personnel from across the state including CTE administrators and teachers, community college and university faculty, members of industry advisory boards and Board of Education.
 <i>Rec. 3a.</i>	2. Issue competition for Governor's Academy Planning Grants. Applicants must be regional public-private partnerships between major employers in a region, regional/ local workforce and economic development officials, school divs, postsecondary institutions, and the general public.	Project team develops criteria, with participation of industry advisors and all education sectors. Notice of competition issued by Superintendent of Public Instruction and with supplemental dissemination through Secretaries of Education, Commerce and Trade and Workforce to key agencies and constituencies.
 <i>Rec. 1b.</i>	3. Develop career pathways for students from K-12 through postsecondary and graduate education that prepare students for current high demand, high skill and high wage jobs at various levels of education, and pathways that prepare students for careers strategically targeted for growth to ensure Virginia's success in innovation and knowledge-based industries.	This is an ongoing activity, initiated prior to grant and continuing through grant period and beyond. Key parties are Postsecondary Perkins/Tech Prep Director at the Virginia Community College System and Career Pathways/Tech Prep Leadership Teams at the colleges; DOE Office of CTE Director and local secondary CTE directors at the division and school levels; industry advisors as discussed in E.5 above; higher education faculty where appropriate based on career pathway; state, regional and local economic development and workforce officials and the Virginia Workforce Council.
 <i>Rec. 1b. and 3b.</i>	4. Participate in second ADP Alignment Institute and conclude work of NASA-facilitated review panels for physics, chemistry and engineering.	ADP Technical Team (12 SOE, DOE, high school, community college, and university faculty/staff), NASA scientist on loan with volunteer review panels of academic and industry experts, and campus review teams from 30 public, private, 4-year and community colleges.
 <i>Rec. 2c.</i>	5. Adapt P-16 Executive Communication Plan to deliver STEM education redesign message.	SOE and P-16 Council
Oct-Dec 2007 <i>Rec. 3a. and 3d.</i>	6. Propose Governor's Exemplary Standards and Guidelines for Governor's Academies for CTE to Board of Education and disseminate information to school divisions upon adoption.	Recommendation to Board from Superintendent of Public Instruction. (See activity 1 for make-up of planning team.)
	7. Award Governor's Academy Planning Grants and initiate technical assistance to regional consortia.	Superintendent of Public Instruction to issue. Project team and P-16 agencies (DOE, SCHEV, VCCS) provide technical assistance, coordinated by DOE project director.
Jan-Mar 2008 <i>Rec. 3a. 2d., 2e. Rec. 3d.</i>	8. Introduce and support legislative package including operational add-on funds for Academies and codification of P-16 Council.	Governor, Policy Office and SOE staff.
	9. Collect baseline data for all indicators	Coordinated by DOE Project Director.
	10. Develop materials and incentives for Exemplary Standards Awards (e.g. banners and labelwear)	Coordinated by DOE Project Director with input from project team.
Apr-Jun 2008 <i>Rec. 3a. Rec. 3d.</i>	11. Accept and evaluate proposals for SY 2008-09 Governor's Academies, award up to 6 Academies.	Review team with industry, secondary education, community college, university, economic development, and workforce representation make recommendations to Superintendent. Coordinated by Project Director. Superintendent recommends to Board of Education.
	12. Accept and evaluate applications for Governor's Exemplary Standards Awards, confer awards.	DOE staff evaluates proposals. Recommendation to Board from Superintendent of Public Instruction. Attainment of standards must be validated by local industry advisory group prior to application to state.
July-Sep 2008 <i>Rec. 3a. Rec. 3d.</i>	13. Initiate up to 3 Governor's Academies for CTE	Regional partnerships with technical assistance and oversight from DOE, VCCS and SOE staff.
	14. Continue evaluating applications and awarding Exemplary Standards awards.	Same as 12.

Month/ <i>Recomm.</i>	Grant Activities	Responsible Parties
Oct-Dec 2008 <i>Rec. 3a.</i>	15. Closely monitor implementation of Academies.	DOE Project Director with SOE, DOE and VCCS staff.
Jan-Mar '09 <i>Rec. 1a, 3a, 3d.</i>	16. Introduce any additional legislation and funding required for Awards and Academies.	Governor, Policy Office and SOE staff.
Apr-Summer '09	17. Complete major activities, collect outcome data for indicators and evaluate project.	SOE and DOE staff.

The activities directly support the **structure** of the grant by laying the groundwork for and then establishing a **network** of Governor's Exemplary CTE Programs. Programs in this network will share best practices with each other and with other programs striving for the designation. The network may include new centers developed in response to this project and existing centers that rise to high standards or refocus their programs to advance Virginia's STEM agenda.

The activities address both NGA **core objectives** and directly support the mission, goals and specific objectives for Virginia's initiative. The Academies and Exemplary Standards are new school and standard models for STEM education, and both are eminently scalable. The criteria for both programs will encourage innovative curricular, assessment and professional development strategies. Partnerships with business, higher education and regional workforce officials are integral to both components of Virginia's proposal, as described in E under Core Objective 5.

The primary progress measures for these activities will be:

- ◆ An expanded number and quality of STEM focused schools in the state that serve all student groups
- ◆ An increased number of college-level credits earned by high school students and transferred to postsecondary institutions
- ◆ An increased number of K-12 students taking higher level math courses beyond Algebra I
- ◆ An increased number of students enrolled in CTE programs targeting current employer needs and STEM occupations.

Policy changes required for sustainability

The following policy changes will be required to sustain Virginia's reform efforts beyond Governor Kaine's term:

- ◆ Codification of the P-16 Education Council – Governor Kaine will submit legislation to the 2008 General Assembly to institutionalize this council.
- ◆ Creation of a budget line-item for Governor's Academy for CTE add-on funding, analogous to the Governor's School add-on to Standards of Quality funding.
- ◆ Promulgation of regulations for the new Technical and Advanced Technical Diplomas. The Board of Education has opened the Standards of Accreditation under the Administrative Process Act for this and other changes.
- ◆ Establishment of Board or Department of Education Guidelines and Procedures for Governor's Academies and Governor's Exemplary Standards Awards. These will include policies and procedures, rather than regulation or legislation.

Progress will be measured by the timely development and successful adoption of the laws, regulations and policies identified.

Strategies for building public support

The need to build public support for Virginia's STEM redesign begins with parents and school counselors. Many parents of middle and high school students and counselors are familiar with the vocational education of the last generation, and steer their children away from CTE because they may not understand its potential as a rigorous academic program in a relevant applied context. A primary goal of our communication plan will be to get parents to understand the imperative that students gain STEM literacy and other critical 21st Century skills,

and that a high-quality CTE program is an excellent way for many students to achieve this competency level. We will work with the Virginia Career Education Foundation to communicate this message to students, parents and counselors.

Other important target audiences are education policy-makers including state and local elected and appointed officials and school division personnel, members of the business community, and the general public. The P-16 Education Council will play an important role in communicating the needs for STEM redesign and garnering support for the efforts outlined in this grant proposal and other components of Virginia's STEM agenda. Each member will work with his or her constituent groups (K-12 community, higher education, business, legislature, school boards) to communicate the STEM message. The Governor, the Secretary of Education, and his policy staff will meet with General Assembly leadership, education committee leaders, and members of the House and Senate on this topic, and will keep STEM redesign issues in front of the business community through meetings and speeches with industry groups. The Virginia Workforce Council and the Council for Virginia's Future are business opinion leaders and are represented on the project team. The Governor has several venues in which to appeal to minority population leadership as well. The Governor will continue to use a variety of communications media to bring STEM redesign and CTE to the forefront. This includes use of his and the various education agencies' Web sites; public service announcements; radio talk shows, and news releases.

Progress in building public support will be measured by an increase in the number of students enrolled in CTE programs and earning industry-recognized credentials; increases in press coverage across the state on CTE and STEM education; successful passage of legislation and funding to support Virginia's efforts to reinvigorate CTE; and increased business support for CTE programs.

Budget

Please see Attachment B, budget form, and narrative in section J.

G. Connection to Other State Activities

P-16 Alignment

Virginia established its P-16 Education Council through its NGA Honor States grant. The P-16 approach is critical to the career pathways model for CTE that will be emphasized in our STEM redesign. We are preparing high school students for postsecondary education at various levels and the workplace and must work as a system to align curricula, assessments, credits, and expectations. Current alignment efforts include participating in the ADP Network and partnering with NASA to align science (starting with physics and chemistry) and engineering standards with postsecondary and industry expectations. The Department of Education is exploring the use of end-of-course tests as indicators of college readiness, and how to use those tests to provide remediation while students are still in high school. The General Assembly this year funded a community college transfer grant program to encourage students to earn their Associate Degrees at a community college and transfer to a four-year college, which will support our career pathways approach. Virginia's P-16 longitudinal data system is in its third year of implementation and will be able to provide data on the first complete high school cohort in 2008. When fully implemented, the system will be able to supply data for continuous improvement of the educational system from teacher preparation through student success in postsecondary education and beyond.

High School Reform

Virginia participates in the NGA Honor States grant program, and is in its final year of performance for its grant. Components of our high school reform that are most closely related to STEM redesign include expansion of our Algebra Readiness initiative, programs to promote advanced coursework and industry certification in high school, career planning initiatives and postsecondary awareness programs.

Virginia also participates in the State Scholars Initiative through our Commonwealth Scholars Program. The program was initiated in 11 pilot school divisions in 2006 and is expanding to several additional divisions with support from business in 2007. The lead agency is the Virginia Career Education Foundation (see under CTE below), fitting well with the business partnership aspect of State Scholars. This partnership to raise student awareness of career options and the importance of completing a rigorous course of study will be a key tool in our STEM agenda.

Career and technical education

In 2005 the General Assembly provided funding for the Virginia Career Education Foundation (VCEF), a 501(c)(3) non-profit organization governed by a board of directors representing industry, education, and the legislature. The purpose of the foundation is to further career and technical education in Virginia's Schools. VCEF President Emily Richardson is a member of Virginia's STEM redesign team.

The DOE Office of Career and Technical Education and the Virginia Community College System Office of Postsecondary Perkins/Tech Prep are leading Virginia's work to establish career pathways for students from K-12 through postsecondary education. Their work is increasingly focused on career clusters and pathways in keeping with Perkins IV. Virginia submitted a one-year transitional plan for Perkins this year with a career pathway program of study, and each school division is required to submit at least one career pathway program by June. The Virginia Community College System is requiring colleges to develop or improve, with local school divisions and business and industry, at least three articulated, secondary to postsecondary (4+2 and 4+2+2) Tech Prep career pathways based on local industry needs in order to qualify for Tech Prep funds. State-approved program elements include articulation and dual-enrollment, business and industry partnerships (which this project will leverage as described under E., core objective 5), curriculum improvement and alignment, career coaching and planning, project and work-based learning, transition services and sustainability. The development of career pathways in targeted clusters, and the required participation of industry, economic development and workforce officials are integral to Virginia's STEM redesign. The clusters approach will help to focus Virginia's CTE efforts on programs of study relevant to our regional economies.

There is great interest in advancing career and technical education in the General Assembly, which this year directed the Board of Education to develop two new technical diplomas to encourage students to reach beyond the Standard and Advanced Studies Diplomas to include CTE course sequences.

STEM Education

Virginia offers several highly selective STEM-focused specialty programs including 11 regional Governor's Schools and five school-district run STEM specialty centers. Governor's Schools include academic year programs, residential summer programs and regional, nonresidential summer programs.

The 2006 General Assembly established a joint subcommittee to study science, math, and technology education in the Commonwealth. The subcommittee is exploring current components of STEM education in Virginia. The Superintendent of Public Instruction, Secretary of Finance, Chancellor of the Community College System and President of the Center for Innovative Technology are subcommittee members, along with legislative and business representatives. The Chairman, Delegate John Cosgrove, is enthusiastic about a CTE-based approach and is a member of the project team.

Several universities provide professional development opportunities for inservice teachers. One strong example is the Virginia Tech VT-STEM Outreach Program which offers curriculum and professional development support for K-12, and is part of a larger program combining economic and workforce development with P-12 STEM education improvement.

Workforce realignment and economic development

The Governor, legislature and business community are engaged in a process to realign Virginia's workforce development system. The new structure is still being developed but will rely more heavily than in the past on the community colleges, and is being designed with a strong emphasis on regional clusters and skill attainment at various levels. The CTE approach of this proposal fits perfectly with the goals of workforce system realignment, incorporating a tighter regional industry focus, use of Workforce Investment Boards as advisors, and selection of targeted industry clusters. The Workforce strategic plan calls for all public high school students to have individualized high school plans to ensure course selections are aligned with students' transition and career goals after high school – secondary to postsecondary career pathway frameworks will be a key tool for these plans. The strategic plan also calls for a statewide career pathways and workforce communication plan, which will be coordinated with the STEM redesign communication plan.

H. Governance Structure

The Governor's Academies for Career and Technical Education will be part of the school division, and thus will fall under the governance of the local school board and superintendent. To qualify as Academies, they will be required to have advisory or governing boards including community college, university (where applicable), industry, economic development and workforce officials. In some cases Academies will be Joint Schools as provided for in the Code of Virginia, and will include representation from multiple school divisions within a region on the governing board. Academies will be required to meet criteria established by the project team, subject to review by the Governor's Office and Department of Education. The Exemplary Standards Awards Program will require a local/regional industry-led team to validate that a program has met the rigorous criteria for the awards, before the program can apply to the state for this designation. As noted above, we will leverage relationships with Workforce Investment Boards, industry advisory boards convened by community colleges Workforce Coordinators, and Career Pathways/Tech Prep/Perkins Leadership Teams convened by community colleges and local school divisions for this purpose to the maximum extent possible.

I. Readiness for Change

Several observers have noted that the "stars are aligned" for reinvigorating CTE in Virginia. Raising the rigor and status of CTE was one of the primary education planks in Governor Kaine's campaign, along with early childhood education and creation of a new university in Southside Virginia. The Governor speaks often of his father's experience having to close his small metal-working shop because he could not find qualified employees interested in pursuing skilled work. He also speaks of his experience as a missionary in Honduras, where he served as principal of a technical school that transformed the lives of villagers. The General Assembly has taken up the issue, with numerous proposals in the last few years to expand CTE options for students. This year the Assembly approved legislation (HB 2039, Hamilton/ SB 1147, Wagner) creating two new technical diplomas, one at the Advanced Studies level and one "at or above" the level of the Standard Diploma. The Governor is encouraging the Board of Education to set the Technical Diploma at least at the level of the State Scholars Core. The Assembly also passed legislation requiring school divisions to report the number of CTE completers graduating each year (HB 1978, Lohr/ SB 1148, Wagner). The bill did not pass due to cost concerns, but it is anticipated that over time the Technical Diploma or a diploma reflecting the State Scholars Core may replace the Standard Diploma. Also proposed and passed in one house of the legislature was funding for creation of three comprehensive technical high school programs that stress high academics and career and technical education (Hamilton). These were to be comprehensive, full-day schools demonstrating a working partnership with at least one Virginia college or university, including community colleges, and at least one private sector business partner. The funding was not approved in the final budget conference, but there was extensive support for the concept. The 2006 joint legislative subcommittee studying STEM education is another indication of the legislature's commitment to building an effective STEM policy agenda.

The team members for the grant have worked together extensively in recent years on several initiatives. Most of the team members are engaged in Virginia's NGA Honor States Grant, and have collaborated on the myriad initiatives that are part of that grant program. Many of the team members and their organizations are part of the P-16 Education Council and have worked together for 18 months, primarily on longitudinal data system issues and college and workforce readiness. There are many examples of collaboration among Virginia's high schools, community colleges and public and independent colleges. Virginia's Commonwealth College Course Collaborative provides a set of academic courses that fully transfer as core requirements and degree credits at public and private colleges and universities, and these institutions also collaborate on the VirginiaMentor web site that provides an Early College Transfer Tool showing students how to maximize the amount of college credit they earn in high school. There has been tremendous progress in the last two years in the areas of dual enrollment and articulation and transfer agreements between community colleges and four-year colleges. Several universities are offering guaranteed admission to community college students who meet certain requirements. For example, students who complete an engineering associate degree at a Virginia community college with a grade point average of not less than 3.0 are guaranteed admission to the general engineering program at Virginia Tech.

Virginia has made substantial progress in many areas through its commitment to innovative policies and practices. We are participating in the American Diploma Project Network to develop a common standard for college and workforce readiness, and align standards and assessments accordingly. We are engaged in a parallel process with NASA to review science (starting with physics and chemistry) and engineering standards. Our Standards of Learning are carefully designed to align instruction vertically among grade levels. We have established a unique student identifier in our P-12 data system that can be transmitted to higher education institutions to allow longitudinal tracking across systems. We have established the Career Switchers alternative route to licensure program, and numerous Math-Science Partnerships to improve preparation of K-12 teachers. We have developed outstanding STEM-focused Governor's Schools that enjoy strong support from the legislature.

There is strong bipartisan support for career and technical education. Indeed, the legislative proposals noted above were all patroned by Republican legislators (Hamilton, Lohr and Wagner.) This project is one for which legislators on both sides of the aisle will be able to join constructively with the administration to advance Virginia's education agenda.

J. Budget

Please see budget table in Attachment B and *Specific activities for which funds are requested* under section E above. The fiscal agent for this grant will be the Virginia Department of Education. Funds have been requested for a project director at the Department, at a salary of \$62,000 with a fringe benefit rate of 37.44% including 11.15% required contribution for Virginia Retirement System, 6.20% and 1.45% for Social Security and Medicare, 1% for group life, 1.2% for retiree health credit and 2% for disability coverage, \$8,472 for health insurance and \$480 for cash match to deferred compensation. Grant funds are requested for travel, meeting expenses and supplies for four major activities: Academy planning, Academy implementation, Exemplary Standards planning and Exemplary Standards implementation. A combination of grant and matching funds will be used for grants to regional/local consortia to develop and implement these programs, as follows: \$5,000 incentive grants for 12 CTE programs that earn Exemplary Standards Awards (\$60,000 grant funds), \$20,000 planning grants for 6 consortia to plan Academies (\$20,000 grant funds and \$100,000 match from state-level Workforce Investment Act Funds, letter of commitment provided in Attachment E), \$100,000 implementation grants for 6 Academies (\$200,000 grant funds and \$400,000 match from additional workforce funds sought from Virginia Workforce Council in July allocation process). Additional state funds will support grant objectives, including a to-be-determined per-pupil add-on to state education funding for Academy students, and existing funding for industry certification (over \$1 million annually) and vocational equipment (\$2.3 million annually).

K. Additional Considerations

Virginia is an active partner with the NGA. At the 2007 Winter Meeting, Governor Tim Kaine hosted and facilitated one of three Governors panel discussions on the Chairman's competitiveness agenda. Governor Kaine actively serves on the Education, Workforce and Children's Welfare Committee, and he is a lead Governor on the No Child Left Behind Task force and the taskforce to redesign the American High School.

The Governor's Washington DC representatives work with the NGA's Federal Relations and Center for Best Practices on a regular basis. Virginia staff are currently involved in a host of NGA workgroups, including the WIA reauthorization and Farm Bill reauthorization groups. The DC representatives are also engaged with NGA Federal Relations and Center staff on minimum wage legislation, REAL ID, unemployment insurance, and offshore drilling legislation.

The Commonwealth of Virginia remains one of NGA's most enthusiastic participants. Virginia regularly sends policy advisors to NGA conferences in Washington, DC and around the country. The Virginia Workforce Office has applied to participate in an NGA policy academy on senior volunteerism in the workforce, while education advisors attended a number of meetings on the Chairman's competitiveness initiative. Virginia's involvement has included the participation of cabinet secretaries, governor's staff, and senior agency administrators. Governor Kaine and Virginia officials have been deeply engaged in NGA's Honor States Initiative. The Virginia team has met the requirements of the grant, including implementation of a P-16 Council, and maintains regular contact with NGA staff on the progress of grant activities.

Attachment A - Section A

THE NGA CENTER FOR BEST PRACTICES SCIENCE, TECHNOLOGY, ENGINEERING AND MATH CENTER GRANT PROGRAM GAP ANALYSIS OF VIRGINIA'S POLICY LANDSCAPE

SECTION A: REVIEW OF ECONOMIC AND EDUCATION INDICATORS

I. Introduction

As noted in NGA's *Building a Science, Technology, Engineering and Math Agenda*, a key to developing a workforce with the knowledge and skills to compete is to strengthen science, technology, engineering and math (STEM) competencies in every K-12 student. Virginia has excelled at developing programs for gifted and talented students through outstanding Governor's Schools, specialty centers and various acceleration and enrichment programs. We have also done a good job of producing and attracting college-educated scientists, engineers and other knowledge workers. However, we have fallen short in developing these core skills in the **general student population**, as evidenced by postsecondary remediation data and reports from college faculty and employers regarding the lack of core skills and abilities among high school graduates. We have identified career and technical education as a promising avenue for developing STEM literacy and other critical 21st Century skills through applied learning.

Virginia has serious gaps between workforce demand and supply in technical fields. The workforce shortages in these fields are hampering our ability to attract and retain traditional and new economy businesses throughout industry sectors and geographic areas. While knowledge workers at the upper end of the educational spectrum are needed to fuel innovation, skilled workers at pre-baccalaureate levels are needed to support the very businesses and industries in which innovation occurs.

We have targeted Virginia's proposal to the National Governors Association toward development of model programs in career and technical education (CTE) to raise the quality of programs and to improve alignment with postsecondary expectations in education and the workplace. These programs will expand options for all students to acquire the knowledge and skills that will prepare them for multiple postsecondary pathways, especially for training toward high-wage, high-skill occupations in growing industries.

II. General economic and innovation indicators

Monitor Group: A Competitive Benchmarking of the Virginia Economy

Virginia's economic performance is strong compared to the US for most indicators, with the exception of merchandise exports. **Bold** figures indicate superior performance.

Economic Performance	Virginia	US
Employment growth (1996-2006)	1.80%	1.22%
Unemployment (December 2006)	2.90%	4.50%
Average wage (2005)	\$41,937	\$40,499
Growth rate for average wages (private employees, 1997-2005)	4.79%	3.79%
Merchandise exports per worker (2005)	\$4,065	\$8,099
Growth rate for merchandise exports (199-2005)	-0.14%	4.07%
Gross state product per worker (2005)	\$117,370	\$111,078
Growth rate for gross state product (1997-2005)	4.84%	4.21%

Conversely, Virginia's innovation output is inferior to the national average in nearly every category. Poor performance is most striking in the areas of patents and venture capital (VC) funding, suggesting weakness in idea generation and development and commercialization through investment. Despite these weaknesses, the growth rate for establishments and Virginia's share of fast growth companies is average or high. Again bold indicates superior performance.

Innovation output	Virginia	US
Patents per 10,000 workers	3.43	7.40
Growth rate for patents per worker (1996-2005)	-1.16%	0.73%
Growth rate for total number of establishments (1997-2005)	1.92%	1.93%
Growth rate for number of private establishments (1997-2005)	1.92%	1.95%
Venture capital funding per worker (2005/06)	\$8.37	\$17.91
Rate of growth in VC funding per worker (1997/98-2005/06)	-7.16%	3.58%
Share of Inc. 500 fast growing companies (2006)	6.80%	2.48%*

* this figure represents Virginia's share of US private establishments.

The traded clusters representing the fastest growth and largest employment in Virginia include **business services, financial services, education and knowledge creation, and communication services**, followed by oil and gas, and hospitality and tourism. These are all competitive nationally as measured by the specialization analysis. Relative to the international economy, Virginia's strongest industries are **communication services and education and knowledge creation**. Industries with declining positions are textiles, forest products, information technology products, automotive, plastics and biopharmaceuticals.

The 2007 State New Economy Index: Benchmarking Economic Transformation in the States

The New Economy Index analysis is consistent with the Monitor Group review in identifying strong economic indicators but some weaknesses in innovation capacity. But it shows that the problem may not lie in the composition of the STEM workforce. Virginia beats the nation and all but a few states in the proportion of the workforce employed in knowledge jobs, and in economic dynamism and other new economy indicators such as utilization of digital resources.

Rank	Indicator – strong performance	Rank	Indicator – weak performance
1	IT professionals	18	Industry investment in R&D
1	Fastest-growing firms	21	Foreign direct investment
2	High-tech jobs	26	Patents
3	Knowledge workforce (composite)	32	Export focus of manufacturing
4	Manufacturing value-added	34	Package exports
5	Workforce education	35	Inventor patents
5	e-Government (composite)	47	Entrepreneurial activity
6	Digital economy (composite)		
8	Managerial, professional and technical jobs		
9	High-wage traded services		
11	Immigration of knowledge workers		
12	Innovation capacity (composite)		
15	Gazelle jobs		

Other indicators

Virginia was recognized by *Governing* magazine as the best-managed state in 2005. In 2006 we were ranked as #2 in the Digital States Survey, #1 for technology job creation by the American Electronics Association, and #1 best state for business by *Forbes*. We enjoy close proximity to the nation's capital, and have defense agencies, and an international port terminal and airport providing easy access to global talent.

Virginia's knowledge worker paradox

Virginia has more than its share of scientists and engineers and workers in high tech fields and information technology, managerial, professional and technical jobs. Yet we fall well below the national average in individual inventor patents and total patents, venture capital investment, industry investment in research and development (R&D), foreign direct investment, and entrepreneurial activity.

One hypothesis for this paradox – our high proportion of knowledge workers paired with relatively low innovation indicators – is that many of our leading scientists and engineers are employed by government agencies, or government contractors in Northern Virginia and Hampton Roads. These organizations typically perform "work for hire" and as such, do not primarily develop new products and file patents. When they do create intellectual property, it often accrues to out-of-state firms. Our services-based economy puts us at tremendous risk from innovation elsewhere that may lower the need for government services providers. In response, Virginia has targeted growth in several industry clusters to strengthen and broaden our economic base. Areas targeted by the Virginia Research and Technology Advisory Commission for growth in research and development include energy, life science and semiconductor research, using methods from modeling and simulation and nanotechnology. The primary industry clusters targeted statewide by the Virginia Economic Development Partnership are aerospace, automotive, biosciences (life science), distribution, electronics (including semiconductors), financial services, food processing, motorsports and plastics. Regional industry clusters have also been identified and targeted for development, as noted in the following section. Virginia's efforts to reinvigorate career and technical education will address these targeted industries as well as the immediate needs of Virginia's leading employers in each region.

III. Education indicators related to STEM education agenda

Monitor Group: A Benchmarking of the Virginia Educational System

Virginia performs significantly better than the national average but below top states in most indicators of educational quality and educational attainment. This is true for graduation rates, postsecondary completion rates, NAEP test scores, SAT scores controlled for participation rates, and AP participation rates. Virginia's high school graduation requirements match the State Scholars Core in number of years of math and science required, but Virginia does not identify the specific courses required for graduation in math (beyond Algebra I) and science (beyond "2 lab science courses").

Measuring Up 2006: The State Report Card on Higher Education

The National Center for Public Policy and Higher Education identified the following strengths in Virginia's higher education system, and in its K-12 system as it relates to college preparation:

Preparation

- ◆ Eighth graders in Virginia perform well on national assessments in math, science, and reading. Over the past nine years, 8th graders' performance on the science assessments has improved substantially, exceeding the nationwide increase on this measure.
- ◆ Virginia has consistently been a top performer on the very large proportions of 11th and 12th graders who take and score well on Advanced Placement tests.

Completion

- ◆ Compared with other states, a large percentage of first-year students at community colleges return for their second year. Virginia has consistently performed very well on the percentage of freshmen at four-year colleges returning for their sophomore year.

Benefits

- ◆ Compared with other states, a very high proportion of residents have a bachelor's degree, and this substantially strengthens the state economy. Virginia does a good job in both producing and attracting highly educated citizens.

The Center identified the following weaknesses:

Preparation

- ◆ Low-income 8th graders perform very poorly on national math assessments.
- ◆ Only fair percentages of 11th and 12th graders score well on college entrance exams, but these percentages have increased substantially over the past 12 years.

Participation

- ◆ Compared with other states, the chance of a 9th grader enrolling in college within four years is mediocre, primarily because relatively few high school graduates go on to college directly after high school.
- ◆ The percentage of working-age adults enrolled in college-level education or training has declined over the past decade—exceeding the nationwide decline on this measure.
- ◆ Among young adults (ages 18-24), there are still substantial gaps in college participation between whites and non-whites. In addition, young adults from high-income families are about four times as likely as those from low-income families to attend college—the widest gap in the nation on this measure.

Affordability

- ◆ Net college costs for students from low- and middle-income families to attend community colleges represent about one-third of their annual family income. (Net college costs equal tuition, room, and board after financial aid.) For these students at public four year colleges and universities, net college costs represent 41% of their annual family income. These two sectors enroll 82% of the state's college students.
- ◆ The state's investment in need-based financial aid is very low, even though Virginia has increased this investment since 1992.

Virginia ranks high for educational attainment, with 35% of the working-age population holding bachelors degrees or higher, placing us sixth in the nation.

The College Board: 2007 AP Report to the Nation

Virginia has joined a select handful of states in which 20 percent or more of high school seniors earned a grade of 3 or more on an Advanced Placement (AP) examination, as reported in the College Board's third annual Advanced Placement Report to the Nation. Last year, 20.7 percent of the Commonwealth's public high school seniors earned a grade of 3 or better on at least one AP exam, compared with 19.3 in 2005, and 15.9 percent in 2000. Only three states, New York, Maryland, and Utah, had a higher percentage of seniors earning grades of 3 or better on AP tests during 2006. The national average was 14.8 percent.

Education Week: Quality Counts

Virginia ranked first in the nation on the new "Chance for Success" index, indicating that the typical student in the commonwealth "enjoys higher achievement and is more likely to finish high school and continue on to college than in other states." The component indicators most relevant to Virginia's STEM

agenda include middle school math, high school graduation, postsecondary participation, and adult educational attainment.

The report also notes that Virginia does well with alignment of K-12 with workforce expectations (defines workforce readiness as distinct from college readiness, offers high school diploma with career specialization, has K-12 path for industry-recognized certificate or license, and has K-12 pathway to earn career-tech credits for postsecondary credit. However, the report identified deficiencies in alignment with postsecondary education (college readiness definition, college-prep requirement for high school graduation, alignment of high school credits with postsecondary system, alignment of high school assessments with postsecondary system, and use of high school assessments for postsecondary decisions.) Overall, Virginia is one of 10 states with 9 or more of 15 recommended policies in place for alignment of K-12 with early education, postsecondary education and workplace expectations.

In educational achievement, Virginia does exceptionally well in the following achievement indicators:

Achievement Levels	VA	US
4th grade math – Percent proficient on NAEP (2005)	39.3%	35.3%
8th grade math – Percent proficient on NAEP (2005)	33.4%	28.5%
4th grade reading – Percent proficient on NAEP (2005)	36.9%	29.8%
8th grade reading – Percent proficient on NAEP (2005)	35.7%	28.9%
8th grade math excellence – Percent advanced on NAEP (2005)	7.9%	5.6%
High School Graduation		
Graduation rate – Public schools (2003)	74.9%	69.6%
Advanced Placement		
High AP test scores – Scores of 3 or above per 100 students (2005)	26.7	15.7
Change in AP Scores – Change in high scores per 100 students (2000-2005)	+7.3	+4.8

Virginia's performance is average on indicators of achievement gains and poverty gaps. Our standards and assessments are rated clear, specific, and grounded in content at all levels, and we have a regular timeline for revisions. Effective school accountability policies are in place, with the exception of growth models and reward systems. For standards, assessments and accountability, Virginia is again in the top category, with at least 10 of 17 recommended policies in place.

The Thomas B. Fordham Foundation: The State of Math Standards 2005

The Foundation's review of state math standards in 2005 gave Virginia a "C" for its standards, based on a 2001 revision. The standards earned a "B" for clarity, a "C" for content, and "D" grades for reason and negative qualities. The report commended Virginia's treatment of measurement and basic number facts in elementary education, but criticized its reliance on technology (calculators) and scant attention to solving word problems and learning algorithms, and a lack of coordination in the development of fractions and decimals. For secondary education, the report found Trigonometry, Mathematical Analysis, and Calculus standards to be well written and appropriate for college-bound students, but faulted deficiencies in the Algebra I, Geometry, and Algebra II standards, particularly insufficient development of deductive reasoning in Geometry.

U.S. Chamber of Commerce: Leaders and Laggards Report Card

The recent Chamber report card gave Virginia high scores for academic achievement, including achievement of low income and minority students, return on investment, rigor of standards, postsecondary and workforce readiness, 21st Century teaching force, and flexibility in management and policy. Virginia was awarded a "C" for data quality and a "D" for truth-in-advertising about student proficiency, based on

discrepancies between proficiency rates on state math and reading assessments and the comparable NAEP assessments.

IV. Demand vs. supply of STEM educated workforce

State reports: targeted occupations and demand

As documented in Virginia's Economic Development Strategic Plan (2006), the composition of Virginia's workforce by industry is changing. Traditional manufacturing is declining, and the service sector continues to grow. Administrative support and sales are the two largest occupational categories, accounting for more than a quarter of the state's work force. The occupational areas projected to grow fastest are computer specialist, business and financial services, and health care support.

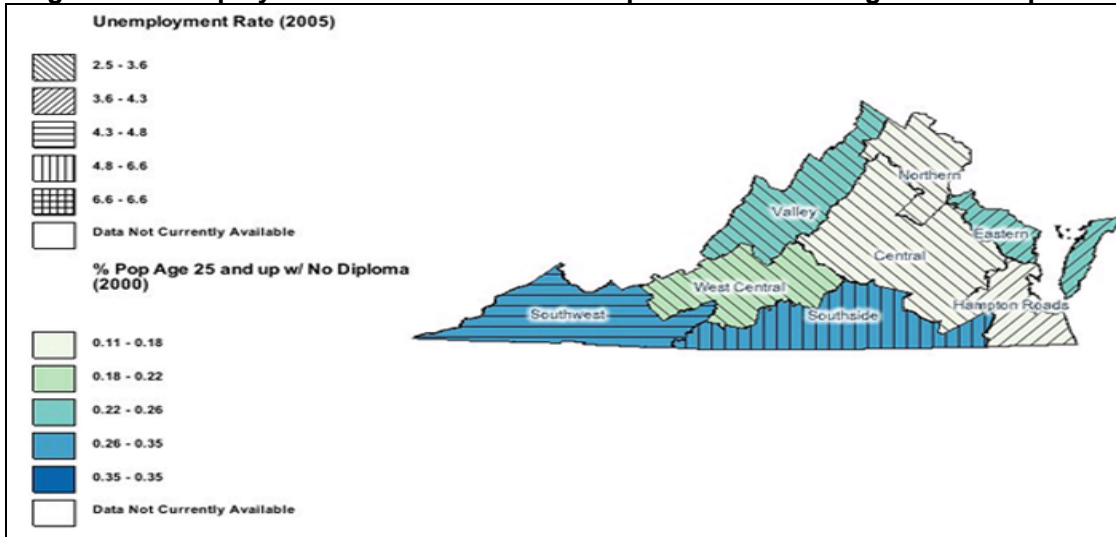
Table 1: Specific Occupations with Largest Percent Increase in Employment, Virginia, 2002-2012 (>499 openings)

Rank	Occupational Title	Employment			Openings		
		Est. 2002	Proj. 2012	% Change	Replacemts	Growth	Total
1	Network Systems & Data Communic.Analysts	5,507	9,308	69.02%	648	3,801	4,449
2	Medical Assistants	7,206	12,146	68.55%	1,333	4,940	6,273
3	Database Administrators	4,911	7,864	60.13%	508	2,953	3,461
4	Physical Therapist Aides	916	1,456	58.95%	153	540	693
5	Veterinary Technologists and Technicians	1,169	1,847	58.00%	152	678	830
6	Physical Therapist Assistants	1,229	1,918	56.06%	205	689	894
7	Personal Financial Advisors	2,072	3,220	55.41%	269	1,148	1,417
8	Computer Software Engineers, Applications	24,293	37,650	54.98%	2,402	13,357	15,759
9	Med. Records and Health Information Technicians	3,353	5,127	52.91%	480	1,774	2,254
10	Self-Enrichment Education Teachers	2,075	3,165	52.53%	255	1,090	1,345
11	Fitness Trainers and Aerobics Instructors	5,196	7,880	51.66%	1,192	2,684	3,876
12	Computer Software Engineers, Systems Software	18,660	28,293	51.62%	1,845	9,633	1,478
13	Home Health Aides	9,238	13,966	51.18%	1,210	4,728	5,938
14	Dental Hygienists	3,922	5,897	50.36%	334	1,975	2,309
15	Network and Computer Systems Administrators	12,274	18,451	50.33%	1,361	6,177	7,538
16	Environmental Engineers	1,606	2,402	49.56%	273	796	1,069
17	Dental Assistants	7,404	11,061	49.39%	2,070	3,657	5,727
18	Computer and Information Systems Managers	10,215	15,099	47.81%	1,855	4,884	6,739
19	Residential Advisors	1,310	1,913	46.03%	276	603	879
20	Management Analysts	30,973	45,216	45.99%	4,237	14,243	18,480
21	Tax Preparers	3,813	5,530	45.03%	628	1,717	2,345
22	Physical Therapists	2,987	4,303	44.06%	294	1,316	1,610
23	Occupational Therapists	1,717	2,473	44.03%	232	756	988
24	Security Guards	24,644	35,267	43.11%	5,363	10,623	15,986
25	Medical and Public Health Social Workers	1,364	1,939	42.16%	233	575	808

Source: Virginia Workforce Council, Workforce Development Blueprint (2002)

Declines in traditional textile, apparel, tobacco and manufacturing over the past decade have decreased opportunities for lower-skilled workers, particularly in rural areas of the state. These rural areas have the lowest educational attainment, which affects the ability of regions to attract emerging industries that provide good wages. Not surprisingly the areas with the lowest educational attainment, Southside and Southwest Virginia, have the highest unemployment. (See Figure 1.)

Figure 1: Unemployment rate and Percent of Population with no High School Diploma



Source: VirginiaPerforms

Virginia is concentrating its economic and workforce development efforts in these regions on raising educational attainment including high school graduation and postsecondary education and training through various routes, and targeting training to meet the current needs of employers and to attract the regionally targeted high-wage industry clusters. To a great extent, this means providing skilled labor for existing industry clusters as well as providing knowledge workers for emerging clusters.

Roles in highest demand for existing companies in these geographic areas include metal workers, electricians, precision machine operators and technicians, industrial mechanics, transportation and materials workers, pipe-fitters, construction professionals and other skilled workers. See Table 2 for examples from one region in Southwest Virginia. These high-demand occupations are also high-wage and skill-intensive. The Virginia Workforce Development Blueprint provides comparable data for each of 23 regions in the state (<http://www.vwc.virginia.gov/pdfs/workforcedevblueprinttrpt.pdf>).

Table 2: Selected high demand occupations by cluster type for Virginia Coalfields Region, 2004q4

Region	Occupation	Est. Employment
Existing industry clusters	Registered nurses	1124
	Truck drivers, heavy and tractor-trailer	952
	First-line supervisors/managers, construction trades & extraction	305
	Operating engineers and other construction equip. operators	277
	Mobile heavy equipment mechanics, except engines	266
	Electricians	149
	Industrial truck and tractor operators	135
Emerging industry clusters	Civil engineers	45
	Electrical engineers	41
	Computer systems analysts	29
	Computer software engineers, systems software	21
	Computer software engineers, applications	20
	Civil engineering technicians	20

The distribution of employment in the Virginia Coalfields example illustrates the dual challenge of Virginia's workforce system: to meet current employer needs and prepare for emerging needs in occupations with a wide range of education and training requirements. Compounding this challenge, the skilled trades and other support roles have become increasingly technological, and companies are having tremendous difficulty finding qualified workers for these positions. While more students are attending Virginia's community colleges and transferring to four-year colleges, fewer are completing training and apprenticeships in skilled fields to provide the essential workforce to keep businesses in operation. Without these essential workers, Virginia will not be able to retain and attract STEM or other industries to its regions.

The Virginia Economic Development Partnership and the Workforce Development Services Division of the Virginia Community College System conducted a joint analysis of industry and occupation clusters (<http://www.virginiaallies.org/research.asp#cluster>). Where traditional industry cluster analysis is used to group industries that share a similar customer and supplier network, occupational cluster analysis is used to group industries that draw from the same pool of skilled workers. By using these two methods in combination, they identified industry recruitment targets that are a good fit for the region, both in terms of their connection to the existing regional industry base, and in terms of their compatibility with the region's existing workforce. The results include both existing and emerging industry clusters with good growth potential. The findings also provide insight about the knowledge and skills needed by employees of the target industries.

The analysis uses seven regions. There were some growth industries identified for all regions, including finance and insurance, health care, wood products and furniture manufacturing, and information technology and professional services. Others were regionally based, including specialized manufacturing (metals and related, electronics equipment and instruments, medical-related and automotive), communications, entertainment, publishing and broadcasting, and chemicals and materials. The manufacturing jobs in demand often require specialized skills to work in highly automated production environments.

An review of STEM occupations by the Virginia Workforce Council for this project showed Virginia has approximately 120 STEM-related occupations. The majority of these are high wage and about one-half can be considered high-demand. Most computer-related occupations are high demand and high wage, whereas engineering and math occupations generally are not. The greatest gaps between supply and demand are in computer engineering and computer systems, while there is an oversupply for business management and biological/life science occupations. Northern Virginia leads the commonwealth by far in demand for high wage STEM occupations, followed by Hampton Roads. The lowest demand is in Southwest and Southside Virginia.

A more general review of occupational gaps in the Workforce Development Blueprint cited above shows the largest current annual gaps for the following occupations, as state totals based on the likely supply of graduates from the relevant education and training programs:

Market research analysts	Computer software engineers – applications
Accountants and auditors	Computer software engineers – systems
Computer programmers	Registered nurses
Elementary school teachers	Computer support specialists
Secondary school teachers	Medical records and health info technicians
Computer systems analysts	Automotive service technicians and mechanics

These high demand occupations are a mix of high wage/high skill (business and financial services, computer-related occupations, nurses, and auto mechanics) and medium wage and/or skill level (teachers, health support).

As noted in all of these analyses, the greatest gaps between supply and demand are not in science and engineering occupations, but in some technology fields, as well as services and trades. Many of the high demand occupations require specialized training at the associate degree or certificate level. A recent estimate from the Virginia employment commission indicates that only about half of positions that are expected to be in high demand through 2012 will require a bachelor's degree or higher.

State higher education: supply

According to NSF analyses of U.S. Department of Education data, Virginia is in the top quartile of states for science and engineering degrees as a percent of all degrees conferred (2000). Between 2001 and 2005 the number of college students enrolled in science, technology, and mathematics-related subjects graduating within three years after choosing their major has remained relatively constant. Also constant has been the attrition in these majors – approximately half of students who declare STEM majors do not graduate in those disciplines within 3 years of declaring.

Although Virginia ranks well relative to other states in its production and supply of scientists and engineers, we also realize that in comparison to international competitors we are far behind. Virginia's colleges and universities have initiated several programs to encourage students to select and persevere in STEM fields, especially underrepresented populations, and some of these show promising results. In addition to the efforts of Virginia's public and private four-year colleges, our community colleges play a large role in preparation of the STEM and related workforce, often closely tied to local and regional industry needs. STEM programs comprise a significant part of the offerings at all 23 community colleges, with over 25 academic programs in STEM-related disciplines. In 2005-06, almost 19,000 students were enrolled in Math, Science and Technology degree programs, and in 2004-05 over 1,500 students completed programs in Science and Engineering. The community colleges also offer certificates and diplomas in closely related program areas including biomedical technology, engineering technology and modeling and simulation. Additional efforts are underway to examine and improve the preparation of students in K-12 education for additional study in STEM disciplines.

Misalignment: skilled workforce

As noted above, Virginia does a relatively good job of producing and attracting workers at the most highly educated levels in STEM fields, including scientists and engineers. We are less successful in developing workers with specialized postsecondary and occupational training such as technicians, technologists and skilled labor. At a recent Governor's Manufacturing Summit researchers projected that approximately 40% of the skilled labor workforce is expected to retire in the next five years, and the pipeline to replace these workers is inadequate. The Virginia Biotechnology Association notes that Virginia anticipates more than 100,000 retirements among advanced manufacturing workers (including 45,000 technically skilled workers) over the coming decade and a major surge of demand for skilled labor as our state's bioscience, pharmaceutical, and semiconductor companies continue to expand their operations.

V. Student achievement and attainment in STEM education vs. postsecondary and workplace expectations

Several efforts are underway in Virginia to identify gaps between K-12 student achievement and postsecondary education and workplace expectations.

Virginia has joined the American Diploma Project Network (ADP) and is in the process of aligning state *Mathematics and English/Language Arts Standards of Learning* with Achieve's ADP benchmarks. We are currently participating in the Alignment Institutes, and completed the first institute in March. The remaining institutes will take place in July and September. As part of this process, 30 colleges including ten public four-year institutions, ten independent four-year institutions and ten community colleges are providing feedback on the areas in which they identify weakness in student preparation, skills and abilities. Survey responses and results of faculty discussions have been collected and are now in process of being analyzed. The alignment team's work will conclude this fall with recommendations to the state Board of Education for revisions to the Standards of Learning.

Virginia has also entered a partnership with NASA to review state science and engineering program standards. NASA has provided a scientist on loan to the office of the Secretary of Education to convene review panels of industry, federal lab and higher education representatives to identify the expectations for all students in science and engineering, to compare those expectations with existing competencies and standards, and to identify any gaps between the two.

As part of our NGA Honor States Grant funded by the Bill and Melinda Gates Foundation, we are undertaking a study of remediation in community colleges. This study is designed to identify the weaknesses in high school preparation that result in the need for developmental coursework in math and English at the college level.

The Board of Education has directed the Department of Education to conduct a study of the association between student scale scores on Standards of Learning assessments in high school and the successful completion of first-semester college courses, to determine whether there is a scale score that represents readiness for credit-bearing college-level work.

All three of these efforts are currently in progress and results are not yet available. However, the following data shed some light on the gap, and recent progress, in meeting postsecondary expectations:

- ◆ Remediation rates for entering college students were 21.6% in 2005 and 18.5% in 2006 (Percentage of recent high school graduates entering higher education requiring remediation in reading, writing, or mathematics).
- ◆ The proportion of high school students graduating with an Advanced Studies Diploma was 46.7% in 2005 and 48.2% in 2006. The Advanced Studies Diploma exceeds the State Scholars Core.
- ◆ The percentage of students taking college-level coursework in high school rose from 17% in 2005 to 19% in 2006 and continues to grow, with more students taking Advanced Placement, dual enrollment and International Baccalaureate programs.
- ◆ The number of students earning industry credentials in high school rose from less than 6,400 to over 10,000 from 2005 to 2006.

Researchers at the Weldon Cooper Center at the University of Virginia interviewed over 500 employers in Virginia to find out which skills employers looked for in their entry-level employees. Over a period of 3 ½ years, a study was conducted that captured the thoughts of employers regarding entry-level jobs requiring less than a four-year college degree. The results of that study were summarized in *Virginia's Changing Workplace: Employers Speak*. This study provided the foundation for the Virginia's Workplace Readiness Skills, developed by the Virginia Beach City Public Schools' Office of Technical and Career Education through a grant from Opportunity Inc., Hampton Roads' Workforce Development Board. The 13 Workplace Readiness Skills cover reading, writing, math, speaking and listening, computer literacy, reasoning, problem-solving and decision-making, "big picture" understanding, work ethic, attitude, independence and initiative, self-presentation, attendance and teamwork. Detailed standards for each skill, along with strategies, exercises and many related resources, are available at <http://www.thecapcenter.com/workplace/> and <http://www.cteresource.org/publications/featured/wpr/index.html>. These skills have been incorporated into the required competencies in Virginia's career and technical education programs for public schools.

VI. Evaluation of current policies governing K-12 STEM education

The data presented above point to several strengths and weaknesses in Virginia's STEM education system and policy framework.

Readiness for postsecondary STEM education: course requirements, standards and assessments

Virginia's Advanced Studies Diploma requirements provide solid preparation for postsecondary STEM education. Current initiatives underway to promote readiness for all students include participation in the American Diploma Project Network to develop a common standard for college readiness across K-12, higher ed and the business community; and the State Scholars Initiative to increase the number of students taking a rigorous course of study in high school. The Board of Education's study of the predictive value of SOL scale scores for success in the first semester of college will also help students and educators peg the level of achievement for which they are aiming. Alignment of assessments with revised standards will follow adoption of the standards. The minimum requirements for graduation with a Standard Diploma do not match up well with college readiness standards.

The commonwealth is currently setting the bar higher for Standard Diploma students with Commonwealth Scholars and newly-authorized Technical and Advanced Technical Diplomas, but has yet to grapple with whether to raise the floor so that all students graduate ready for postsecondary education and training. The Board of Education will also have to determine whether to adjust passing scores on standardized assessments to align required knowledge for college courses with graduation requirements.

Readiness for the STEM workforce: academic and technical preparation through CTE

Many of Virginia's career and technical education (CTE) programs are adopting the tech-prep model of integrated academics and career and technical education, work-based learning, and transition agreements to postsecondary education, in the context of well-articulated career pathways. This approach will be the focus of our Perkins proposal under the new reauthorization. CTE programs use industry-validated competency lists, crosswalk competencies with Standards of Learning, and incorporate Virginia's Workplace Readiness Skills in their competencies. There is an increased emphasis in our CTE programs on achievement of a degree, certificate or credential, and a focus on high skill, high wage, high demand occupations.

The General Assembly passed legislation this year requiring the Board of Education to approve a new Technical Diploma, with requirements at or above the level of the current Standard Diploma plus a CTE

course sequence. The Governor amended the legislation to include a second new diploma, the Advanced Technical, which would mirror the current Advanced Studies Diploma requirements and add a CTE sequence. The Governor is encouraging the Board of Education to set the requirements for the Standard Technical Diploma at least at the level of the State Scholars Core, to ensure that students who earn this diploma will be prepared for multiple postsecondary pathways. These new diplomas will help Virginia raise the profile of career and technical education, will encourage students to strive for higher academic achievement along with CTE course completion, and will help to populate career pathways in high-demand fields for the commonwealth. However, there continues to be significant unmet demand for skilled workers throughout the commonwealth, and concerted efforts to encourage more students to gain high-demand skills will be needed to bridge this gap.

The P-16 Council recommended that the Board of Education consider requiring all graduates, not only those in CTE programs, to demonstrate mastery of Virginia's 13 Workplace Readiness Skills. In addition, Virginia pioneered the Career Readiness Certificate that has been adopted by ACT nationally, using the Work Keys assessments. These assessments and certificates, accepted by many Virginia employers, are administered through our community colleges and other sites and are available to high school students.

Participation in postsecondary education

Participation of young adults in postsecondary education is low (34%) relative to top states (41%), and as noted above there are troubling gaps in participation between whites and other ethnic groups, and between high-income and low-income students. Efforts are underway to encourage all high school graduates to pursue postsecondary education and training, through communications, financial aid, college awareness programs, college transition programs, career pathways, career coaches in high schools, and articulation and transfer agreements, in addition to improved preparation. More efforts are needed in these areas.

Higher education research infrastructure

Virginia recognizes the importance of a well-developed infrastructure for scientific research, with close collaboration between leading research centers and industry. We have invested in seed grant programs to help universities strengthen promising research programs in strategic areas of investigation, with the assistance of experts from the National Science Foundation and leading research institutes nationally. Governor Mark Warner convened a blue ribbon panel to review Virginia's top academic research programs for their potential to be national and international leaders in their fields. The most promising programs received funds for faculty recruitment packages, graduate student aid, laboratory equipment, and new research facilities in a \$500 million public-private partnership in 2006. Governor Kaine has continued funding the research initiative, with investments targeted to strategic industries and regions.

The Commonwealth Technology Research Fund was established to attract public and private research funding for institutions of higher education, in order to increase technological and economic development in Virginia. The Fund has four components:

- 1) Matching Funds Program to leverage federal and private research dollars. Awards from this program shall be contingent upon the approval of the applicant's grant proposal for federal or private funds;
- 2) Strategic Enhancement Program to upgrade the research capacity of those academic departments that have demonstrated the ability to perform innovative research in technology fields with strong potential to contribute to economic development in the Commonwealth;
- 3) Industry Inducement Program to upgrade research capacity in key departments of the institutions in order to attract specific companies to locate or expand in Virginia; and

- 4) Technology Commercialization Program to enhance the capability of the institutions of higher education to commercialize technologies developed through their research.

The fund is administered by the Virginia Research and Technology Advisory Commission (VRTAC) and the Innovative Technology Authority. VRTAC ensures business input into allocation of research infrastructure funds, and encourages multi-university collaboration where synergies may exist. All awards from the fund must be matched at least 1-to-1 with private or institutional contributions. At present VRTAC is emphasizing opportunities in energy, life science and semiconductor research, using methods from modeling and simulation and nanotechnology.

Other policy considerations

Other policy gaps identified in national reviews include the lack of a formal definition of school readiness; the lack of a formal definition of college readiness; lack of alignment between secondary and postsecondary systems in credits, course requirements and assessments; failure to use growth models in state accountability system; lack of rewards for high performing schools; lack of vertically-equated scores across elementary grades, and the absence of a graduation rate measure in individual school and division accountability measures. Virginia is currently developing definitions for school readiness and college readiness through our early childhood and P-16/American Diploma Project efforts. Alignment between secondary and postsecondary sectors is central to the ADP commitments. Governor Kaine and the Board of Education are currently developing incentive and reward systems for excellence in school performance. And the Board of Education has re-opened the Standards of Accreditation regulations that govern the state accountability system. There will be significant open discussion over the next year on the accountability provisions, including consideration of the use of growth models and graduation rates in accreditation decisions, as these rules proceed through the regulatory process.

VII. STEM education redesign agenda

- A. Align K-12 STEM standards and assessments with postsecondary and workforce expectations for what high school graduates know and can do.
 1. Align standards with international benchmarks through state-level participation in international assessments. Virginia is exploring a 2009 commitment to participate in the 2011 TIMSS administration.
 2. Align K-12 expectations with all postsecondary pathways. Virginia is participating in the American Diploma Project Network to align K-12 standards and assessments with postsecondary and workplace expectations, and in a partnership with NASA to review science (starting with physics and chemistry) and engineering standards.
 3. Align STEM expectations between elementary, middle and high school levels to create a coherent K-12 system. Virginia's Standards of Learning standards, curriculum frameworks and assessments serve to align instruction vertically among grade levels.
- B. Examine and increase the state's internal capacity to improve teaching and learning.
 1. Support the continued development of a virtual P-16 longitudinal data system to track preparation of students, including those in STEM fields. Virginia continues to pursue resolution to legal barriers in sharing data across educational agencies. Significant progress has been made in overcoming technical barriers and in developing a robust K-12 longitudinal data system. Robust higher education and teacher preparation information systems are also in place.

2. Develop a communication strategy to engage the public in the urgency of improving STEM education. Virginia will develop a multi-faceted communication plan to reach key audiences with this message.
 3. Support the P-16 Education Council in its leadership of the alignment of expectations throughout the education system and the workplace, including STEM expectations. Governor Kaine has announced his intention to submit legislation to continue the P-16 Council in statute. The Council will be charged with overseeing the implementation of the commonwealth's STEM agenda.
 4. Support promising new models of recruiting, preparing, certifying, compensating and evaluating teachers in STEM content areas. Virginia's Career Switchers alternative route to licensure program has grown steadily since its inception in 2000. The Governor's budget will include expanded support for the critical mentoring component of this program, which will expand the capacity of the program to accept new candidates. Since 2003 the Mathematics and Science Partnership (MSP) Grant has funded 25 projects that provide high-quality professional development in mathematics and science to K-12 teachers. The state also provides teacher recruitment and retention incentives for hard-to-staff schools, a Virginia Middle School Teachers Corps to improve math instruction in middle schools, a teaching scholarship loan program for students who are preparing to teach in a critical shortage area, and fee assistance and incentive rewards for National Board Certification. (Additional details in Section B.)
 5. Support extra learning opportunities to support STEM teaching and learning in the schools. Virginia schools support innovative teaching and learning opportunities including FIRST Robotics, FIRST Lego League, and Virginia Junior Academy of Science.
- C. Identify best practices in STEM education and bring them to scale.
1. Virginia will continue to support specialized STEM schools including our outstanding Governor's Schools and other specialty programs.
 2. Maintain standards and assessments in technology and engineering as well as math and science. Virginia's Technology Education curricula are correlated to the International Technology Education Association (ITEA) Standards for Technological Literacy. Possible standards for engineering education are being studied by the National Center for Engineering and Technology Education, and recommendations regarding standards for engineering in education are being studied by the National Academy of Engineering. Virginia has partnered with NASA to examine the alignment of science and engineering curricula to current and emerging postsecondary and industry expectations.
 3. Support the development of high quality STEM curricula for voluntary use by districts. Available curricula addressing STEM education for K-8 include: Children's Engineering, Introduction to Technology, Inventions and Innovations, and Technological Systems. These programs are open to all students.

4. Develop standards for rigorous and relevant CTE programs that prepare students for STEM related occupations.

This is the focus of Virginia's grant proposal to the National Governor's Association.

- a. Develop career pathways for students from K-12 through postsecondary and graduate education that prepare students for current high demand, high skill and high wage jobs at various levels of education. Work is underway to accelerate development of relevant secondary to postsecondary career pathways, utilizing the flexibility and framework in Perkins IV.
- b. Develop career pathways for students from K-12 through postsecondary and graduate education that prepare students for careers strategically targeted for growth to ensure Virginia's success in innovation and knowledge-based industries. Work is underway as noted in a.
- c. **Develop Governor's Exemplary Standards for Career and Technical Education** as a high standard for CTE programs in schools, localities and regional centers to achieve. Provide Governor's Exemplary Standard Awards to programs meeting the high standard.
- d. **Create Governor's Academies for Career and Technical Education**, modeled on Virginia's very successful Governor's Schools program, to raise the rigor and quality of career and technical education in the commonwealth. Up to three Academies will be created in the first phase of development. Academies will offer career pathways addressing both a. and b. above, commit to meeting exemplary standards, work closely with local and regional employers and workforce developers to meet industry needs, and offer acceleration options for students including dual enrollment, industry certification and licensure and work-based learning. They will serve as model programs for the transformation of career and technical education throughout Virginia and the nation.

Virginia Attachment A - Section B

THE NGA CENTER FOR BEST PRACTICES SCIENCE, TECHNOLOGY, ENGINEERING AND MATH CENTER GRANT PROGRAM GAP ANALYSIS OF VIRGINIA'S POLICY LANDSCAPE

SECTION B: RESPONSES TO GUIDING QUESTIONS PERTAINING TO *BUILDING A SCIENCE, TECHNOLOGY, ENGINEERING AND MATH AGENDA*

1. ALIGN OUTPUTS (STEM COMPETENCIES IN HIGH SCHOOL GRADUATES) AND INPUTS (EXPECTED STEM COMPETENCIES IN INCOMING STUDENTS AND EMPLOYEES) ACROSS THE K-16 EDUCATION SYSTEM AND INTO THE PRIVATE SECTOR

- a) What types of STEM focused assessments are included in your state's K-12 assessment system? Specifically, does your assessment system include: a) college ready measures; b) high school graduation exams; c) end-of-course exams; d) level exams for movement from one grade or one level (e.g. elementary to middle) to the next ; e) diagnostic exams; f) culminating projects; g) industry specific certifications; and/or h) others? Which of these are required by the state for all students and which are voluntary on the part of districts, schools, and/or students?

Virginia's K-12 assessment system consists of required end-of-course tests at the high school level. Virginia has end-of-course tests for the following STEM courses:

- Algebra I
- Geometry
- Algebra II
- Earth Science
- Biology
- Chemistry

For a standard diploma a student must pass 1 mathematics and 1 science end-of-course assessments (verified credits) among other assessments in other discipline areas. For the Advanced Studies Diploma, student must pass 2 mathematics and 2 science end-of-course assessments.

Virginia is participating in the American Diploma Project Network (ADP) to ensure that our mathematics and English/language arts standards are aligned with college- and work-readiness expectations. Assessments will be aligned with any revisions made to the standards through this process, linking high school end-of-course and graduation requirements to college-ready standards. We are engaged in a similar process in partnership with NASA to align science (starting with physics and chemistry) and engineering standards with postsecondary and industry expectations. The Department of Education is exploring the use of end-of-course tests as indicators of college readiness, and how to use those tests to provide remediation while students are still in high school.

In grades K-8, students take *Standards of Learning* assessments in mathematics at the end of grades 3, 4, 5, 6, 7 and 8. In science, students take a *Standards of Learning* assessment at the end of grades 3, 5 and 8. These tests are required for all students.

There are voluntary diagnostic tests offered through the Department of Education. There is an algebra readiness diagnostic test (ARDT) offered to school divisions who wish to diagnose mathematical weaknesses of students in grades 6-9 who are potentially in danger of failing Algebra I. This test is part

of the Algebra Readiness Initiative (ARI), a state program that provides funding for small group tutoring or students at risk of failing mathematics.

Quarterly diagnostic testing is voluntary in mathematics. Many divisions use a pacing guide to assure completion of the curriculum. Locally administered nine-week tests, which coordinate with the pacing guides to diagnose weak areas for focused instruction, are used in many school divisions

Grade and level promotion and retention policies are governed by the local school divisions.

In the Office of Career and Technical Education Services, the following assessments are included for STEM focused classes:

Culminating Projects are required to demonstrate essential competencies in the following courses:

- ◆ Technology Assessment
- ◆ Engineering Design and Development.

Curriculum frameworks that require culminating projects apply to all divisions that offer the courses. In addition, local school divisions may require culminating projects such as senior projects or senior boards. Industry Certifications are currently available at completion of programs and courses for the following:

COURSES AND CORRESPONDING INDUSTRY CREDENTIALS

	Pre-Eng./ Eng. Tech. Assessment (NOCTI)	IT Essentials Cert. Level I (CISCO)	Brain bench Desktop Pub. Softwe. Certs	Mfg Tech Assessments (NOCTI)	AutoCAD	SolidWorks Corp. Cert. Solidworks Professional	Pre-Skills Assmt. for Mastercam Cert.(NOCTI)
Communication Systems (8415)			X				
Computer Control and Automation (8421)		X					
Manufacturing Systems (8425)				X			
Advanced Manufacturing Systems (8427)				X			
Technical Drawing/Design (8435)					X	X	X
Engineering Drawing/Design (8436)					X	X	X
Architectural Drawing/Design (8437)					X	X	X
Introduction to Engineering Design (8439)	X						
Digital Electronics (8440)	X						
Principles of Engineering (8441)	X						
Graphic Communications Systems (8458)			X				
Digital Visualization (8459)					X	X	X
Introduction to Engineering (8490)	X						
Advanced Engineering (8491)	X						

	CompTIA A+	CompTIA A+ Operating Systems Technologies Exam	CompTIA A_ Core Hardware Exam	Basic Installer Exam, Mobile Electronics Certified Professional	Certified Electronics Technical Associate (ETA)	Computer Networking Fundamentals Assessment (NOCTI)	Computer Repair Technology Assessment (NOCTI)	Electronic Technology Assessment (NOCTI)	Student Electronics Technician Certification	Supporting Users and Troubleshooting a Microsoft Windows XP Operating System	Supporting Users and Troubleshooting Desktop Applications on a Microsoft Windows XP Operating System
Information Technology In Production Systems (8496)	X	X	X	X	X	X	X	X	X	X	X
Electronics Systems II (8412)	X	X	X	X	X	X	X	X	X	X	X
Electronics Systems III (8413)	X	X	X	X	X	X	X	X	X	X	X

The new Carl D. Perkins Career and Technical Education Act of 2006 will also require an assessment of career and technical education programs, but at this time it has not been decided by the U. S. Department of Education as to whether the assessments will come at the end of the course or the end of the program and what type of assessment it will be.

The Board of Education has approved a schedule of career and technical examinations for licensure or certification that may be substituted for Standards of Learning tests to earn student-selected verified units of credit. Tests for licensure or certification that require the demonstration of knowledge and skills beyond what is associated with a single course may result in the awarding of two units of verified credit.

- b) What are the required standards, assessments, and courses in STEM areas at the elementary (K-8) level? Do the knowledge and skills (STEM competencies) students are expected to demonstrate by the end of grade eight align with the STEM knowledge and skills needed for success in high school?

At the K-8 level in mathematics and science there are required standards. They can be found online at: <http://www.doe.virginia.gov/VDOE/Superintendent/Sols/home.shtml>.

These standards represent the knowledge and skills students must know and be able to do by the end of grade 8, and are assessed through grade-level end-of-course tests aligned with the standards. The standards are vertically aligned with the high school standards and represent the knowledge and skills needed for success in the high school STEM courses.

- c) What are the courses and credits in STEM areas currently required for high school graduation in your state? Do these align with requirements of the state's postsecondary education system and/or individual institutions for admission? Do the STEM requirements for high school graduation match the STEM curricula recommended by the ACT, the Center for State Scholars, and/or the American Diploma Project? Does the state provide districts and schools with the flexibility to package required STEM content in different ways (e.g., Algebra I, Integrated Math I, etc.), while ensuring consistent quality and content of STEM courses?

In Virginia the courses and credits in the STEM areas for a standard diploma are as follows:

1. Three standard mathematics credits are required. Courses completed to satisfy the mathematics requirement shall be at or above the level of algebra and shall include at least two course selections from among: Algebra I, Geometry, Algebra II, or other mathematics courses above the level of algebra and geometry (2 different courses and passing one end-of-course assessment).
2. Three standard laboratory science credits are required. Courses completed to satisfy the science requirement shall include course selections from at least two different science disciplines: earth sciences, biology, chemistry, or physics.

Courses required for graduation with an Advanced Studies Diploma (3 different courses and passing two end-of-course assessments) are:

1. Four standard mathematics credits are required. Courses completed to satisfy this requirement shall be at or above the level of algebra and shall include at least three different course selections from among: Algebra I, Geometry, Algebra II, or other mathematics courses above the level of Algebra II.
2. Four standard laboratory science credits are required. Courses completed to satisfy this requirement shall include course selections from at least three different science disciplines from among: Earth sciences, biology, chemistry, or physics or completion of the sequence of science courses required for the International Baccalaureate Diploma.

Almost half of Virginia's 2006 graduates earned an Advanced Studies Diploma, which exceeds the State Scholars Core and the ACT course recommendations. The Standard Diploma contains the same number of math and science credits as the SSI core and ACT recommendations, but does not explicitly require Algebra II or physics. However, most (more than 2/3) students who complete the Standard Diploma do take Algebra II among their three or more math credits.

The P-16 Council compared the requirements for fulfilling Virginia's high school Standard Diploma, Advanced Studies Diploma, and Commonwealth Scholars (State Scholars) core course of study to the required or recommended courses for admission to each public higher education institution in the Commonwealth as well as the private institutions belonging to the Council of Independent Colleges of Virginia. The results of this comparison indicate that a high school student can graduate with a Standard Diploma without having taken the courses recommended for admission to 15 of 16 public institutions of higher education, and 18-20 of Virginia's 22 private institutions. The primary reason for this is that most postsecondary institutions require or recommend two or more years of foreign language instruction, while there is no foreign language requirement for Virginia's Standard Diploma. Standard Diploma requirements also fall short of many college admission standards in mathematics and laboratory science, partly because they do not specify an Algebra II requirement, and in a few cases, history and social science. However, it is important to note that many students who earn a Standard Diploma exceed the minimum requirements and are eligible and prepared for college admission.

The Commonwealth Scholars curriculum and the Advanced Studies Diploma close the gap between high school requirements and college expectations in many areas. The number of public higher education institutions for which a student does not meet requirements or recommendations, based on coursework, decreases from 15 with the Standard Diploma to eight by following the Commonwealth Scholars curriculum and one with the Advanced Studies Diploma. For private colleges, the number decreases to nine based on Commonwealth Scholars and only one with the Advanced Studies Diploma. The deciding factor is again predominantly the foreign language requirement.

Currently, Virginia is in the process of aligning state *Mathematics and English/Language Arts Standards of Learning* with Achieve's American Diploma Project benchmarks. The American Diploma Project benchmarks are designed to address those concepts and skills needed by students to be prepared for college/university and workplace readiness. The process is being coordinated by the Secretary of Education's office and will be completed in fall 2007. We are engaged in a similar process through a partnership with NASA to review Virginia's science (starting with physics and chemistry) and engineering standards in collaboration with industry advisors and postsecondary content area faculty.

Virginia allows great flexibility in packaging mathematics courses. The traditional course sequence (Algebra I, Geometry, and Algebra II) is available. Integrated courses may be offered in two ways:

1. a 3-year integrated sequence that covers the content in Algebra I and Geometry (as established in the Mathematics Standards of Learning) and then Algebra II as a 4th year option; or
2. a 3-year integrated sequence that covers the content in Algebra I, Geometry, and Algebra II (as established in the Mathematics Standards of Learning) and then a course above the level of Algebra II as a 4th year option.

Virginia's end-of-course (EOC) assessments are administered during the integrated sequences when the local school division determines that students have completed the content in the *Standards of Learning* for a particular course. EOC assessments need not be annual or at the end of the integrated sequence.

- d) Based on current remediation rates in first year college STEM courses, what are the gaps in STEM competencies among high school graduates enrolling in the postsecondary system? Do higher education institutions share data on student performance in first-year STEM courses with sending high schools? How do the high schools and colleges use this data?

Rates of remediation in mathematics have declined but remain close to 15% for first-time, first-year students who have graduated from a Virginia high school in the previous 12 months.

Year	Enrollment in remedial math courses	Total first-year enrollment	Percentage in Math Remediation
2001-02	5117	30364	16.9%
2002-03	4269	29541	14.5%
2003-04	4729	32408	14.6%
2004-05	5669	35006	16.2%
2005-06	4888	35129	13.9%

As part of Virginia's Honor States Grant, the Virginia Community College System is conducting a study of the academic weaknesses of recent high school graduates enrolled in developmental courses. The study seeks to identify the specific topic-area weaknesses, and any patterns regarding the sending schools or school divisions, in order to target interventions. Sharing of student performance data with sending high schools has been identified as a priority for Virginia's virtual longitudinal P-16 data system. However, the K-12 and higher education agencies are working through state and federal legal and policy barriers to sharing of data between agencies. Meanwhile, technical barriers have been addressed: the Board of Education recently approved revisions to the *Regulations Governing the High School Transcript* which allow for an electronic transcript that can be transmitted from school-to-school and from school-to-higher education. The unique student identifier is a required element of the transcript's content, allowing

higher education institutions to capture it in their records. The identifier can be used to match student records between P-12 and higher education systems.

- e) Have the state and its leading employers defined “work ready” standards in STEM areas – the knowledge and skills (STEM competencies) necessary for entry and success in the workplace, either directly out of high school or after some postsecondary education and/or training? Has the state aligned its high school graduation standards in STEM areas with those work ready standards? Does the state require and/or offer work ready assessments (e.g. WorkKeys, Accuplacer, others) for high school students?

Virginia's Workplace Readiness Skills are a required instructional component of all high school CTE courses. Teachers are required to infuse the content of the Workplace Readiness Skills task list in the instructional content for each CTE high school course and use the student competency record to document each student's achievement.

All Aspects of Industry task/competencies are incorporated in all CTE high school courses. The CTE Resource Center provides instructional resources to enhance the teaching of both Workplace Readiness Skills and All Aspects of Industry.

Workplace Readiness Skills and All Aspects of Industry competencies are correlated to Virginia Standards of Learning and essential competencies in all CTE courses. They are available at

<http://www.cteresource.org/publications/featured/wpri/index.html> and http://www.cteresource.org/VERSO/Published/basic_search_form.

Assessments described in this section are not required by the state but may be used at the local school division level.

- f) What high-wage, high-skill occupations are expected to grow in the state? What are the STEM skills and knowledge requirements of these jobs? What are the current gaps in knowledge and skills (STEM competencies) among entry level employees identified by leading employers in these economic clusters of innovation in the state?

Please see part A of this attachment for detailed information about growing industries and occupations. The occupations with highest projected growth in demand are computer specialists, business and financial services and health care support. Employment is also expected to increase in the industries that include production of goods, construction, transportation and utilities. In addition, industries targeted for growth include aerospace, automotive, biosciences, distribution, electronics, food processing, motor sports and plastics. Industries targeted for investment in R&D are energy, semiconductor electronics and biosciences, using nanotechnology and modeling and simulation (M&S) methods.

Specific gaps in knowledge and skills among entry level employees identified by leading employers in these economic clusters of innovation within the state are not tracked at this time. There are several industry-specific efforts, such as collaborations between Old Dominion University's Virginia Modeling, Analysis, and Simulation Center (VMASC) and Tidewater Community College to provide the spectrum of engineers and technicians needed for the growing M&S industry in the Tidewater area; and another between the Virginia Biotechnology Association and the Virginia Manufacturers Association to lead a Virginia Bio/Advanced Manufacturing Workforce Project to establish certification and assessment standards for advanced manufacturing technicians, develop and operate an outreach, recruitment and pre-screening program, and design, build and operate an innovative training program to qualify advanced manufacturing technicians.

On a more general level, research to identify 13 essential “Workplace Readiness Skills” has been conducted by the Weldon Cooper Center at the University of Virginia, as noted under question e).

- g) Does the state have efforts underway to support collaboration on K-12 STEM education redesign between government, education, and business on a regional basis? Are these collaborative efforts involving the leading economic clusters in the state in a substantive discussion about aligning the goals and strategies of STEM education redesign and improvement with regional workforce needs?

There are fragmented regional collaboration efforts through Workforce Investment Boards, Career Pathways, Tech Prep and Perkins leadership teams, community college business advisory boards, industry advisors for local and regional CTE programs. There is strong interest in coordinating these parallel efforts. In Virginia’s workforce system redesign we are reducing the number of workforce regions and aligning them with community college service areas. This will help to bring clearer regional focus, and to consolidate some of these different efforts into fewer, broader, better-defined collaborations.

Special initiatives and partnerships with business include implementation of model High Performance Manufacturing Technology courses and a Northrop Grumman/Project Lead the Way initiative that is currently being set up to begin in the 2008 – 2009 school year. The Secretary of Education’s Office has partnered with NASA to study how K-12 STEM education initiatives can be strengthened at the local, regional, and state levels through collaboration with industry and higher education. Current education initiatives include Children’s Engineering, Project Lead the Way, Engineering by Design, and the Information Technology-Web Technologies Statewide Articulation Agreement.

- h) How many students graduate from high school in the state with an industry-recognized credential or other work-ready certification in STEM areas? How many students complete career and technical education (CTE) programs, graduate from high school, and score at proficient or above on state assessments in STEM areas?

When the Virginia Department of Education began identifying industry credentials in 2002, only 22 percent of Virginia students were enrolled in courses with the potential for achieving an industry credential. In 2007, 98 percent of career and technical education courses offer training for one or more industry credentials. During the 2005-2006 school year, 10,115 Virginia students earned industry certification credentials, passed occupational competency exams, or achieved state licensure in areas eligible for student-selected verified credit (this includes all CTE program areas). This is about 13% of all graduates and completers. There were 29,807 CTE program completers, representing about 38% of all graduates and completers. Data are not available on the proficiency scores of this subset of students. Overall among high school students, 85% passed state mathematics assessments, 64% passed at the proficient level and 21% at the advanced proficient level. In science, 83% of students passed, 68% at the proficient level and 16% at the advanced proficient level.

- i) Do the requirements for the state’s career and technical education (CTE) pathways in STEM align with secondary level standards, allow students to easily move through the postsecondary system, and lead to meaningful career opportunities in STEM areas?

To help students investigate careers and design their courses of study to advance their career goals, the Office of Career and Technical Education Services has adopted the nationally accepted structure of career clusters and career pathways. To simplify federal reporting, The Virginia Career and Technical

Education Reporting System (CTERS) User's Manual assigns a career cluster to each course. The cluster assignment for each course is identified. Additional information and samples of CTE course selection using career clusters are included in the Administrative Planning Guide, Section 11: Instructional Planning with Career Clusters, Career Pathways, and Occupations.

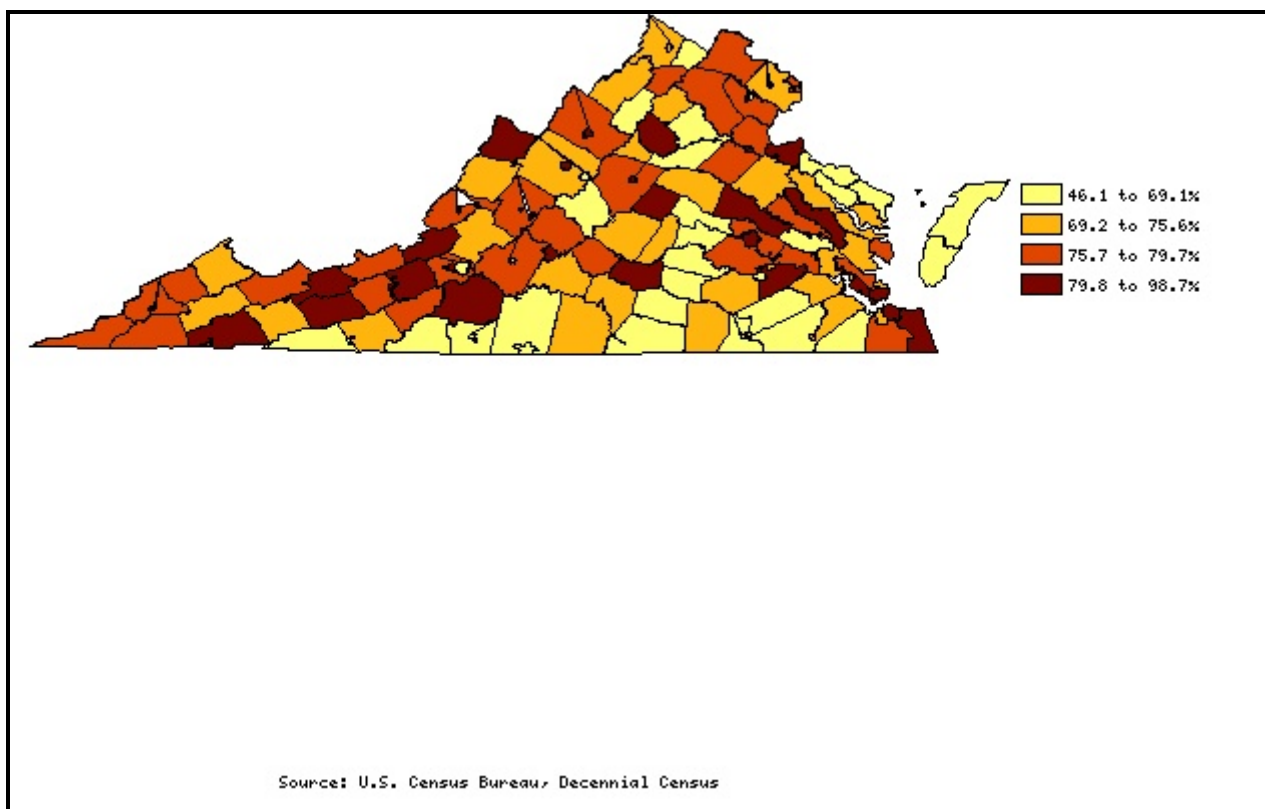
- j) What are the state's CTE clusters focused on STEM areas and are those aligned with the high-wage, high-skill occupations expected to increase in the state?

The following clusters are especially applicable to STEM education: Architecture and Construction; Arts, AV Technology and Communications; Information Technology; Manufacturing; Science, Technology, Engineering and Mathematics; Transportation, Distribution and Logistics; Health Science; and Agriculture and Natural Resources. These are well-aligned with the high-demand, high-wage and high-skill occupations identified through Virginia's industry and occupational cluster analysis.

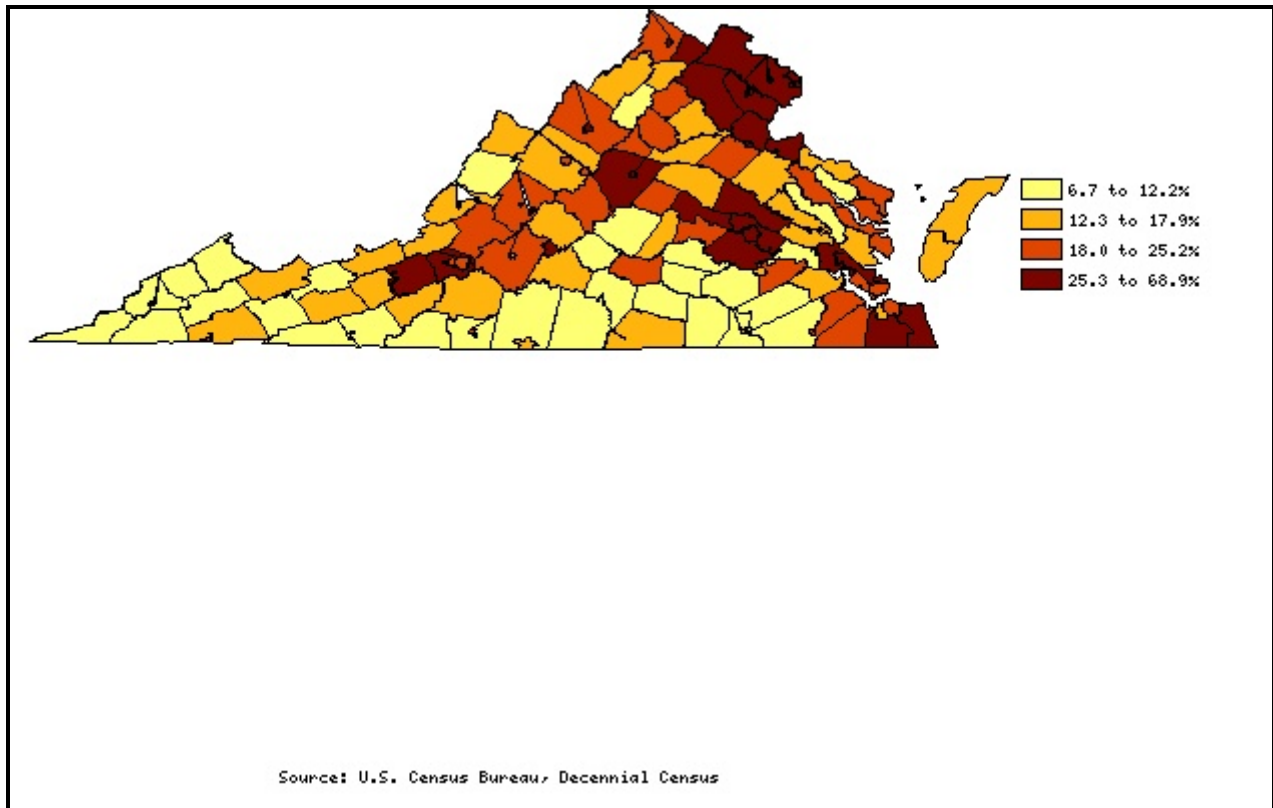
- k) What are the regional differences within the state in K-12 student achievement and attainment in STEM areas, private sector demand for and supply of STEM educated employees, and projections for growth in high-wage, high-skill STEM related occupations?

There is great variation in educational attainment across the commonwealth, as illustrated by the following map from the National Center for Higher Education Management Systems:

Educational Attainment by Degree-Level and Age-Group (Decennial Census) Percent of Adults 18 to 24 with a High School Diploma - 2000 - Virginia



Educational Attainment by Degree-Level and Age-Group (Decennial Census) Percent of Adults 25 to 64 with a Bachelors Degree or Higher - 2000 - Virginia



The Virginia Employment Commission provides data to public schools that reflects regional differences in the private sector demand for and supply of STEM educated employees, and projections for growth in high-wage, and high-skill STEM related occupations.

2. DEVELOP THE NECESSARY STATEWIDE CAPACITY TO IMPLEMENT AN ALIGNED AND RIGOROUS STEM SYSTEM

- a) Has the state evaluated its capacity for improving STEM teaching and learning statewide through state participation on international assessments such as the Program for International Student Assessment (PISA) and the Trends in International Math and Science Study (TIMSS) and comparison of its results to top performing nations? If so, please describe the state's efforts.

The state has not participated in PISA or TIMSS in a manner that would allow us to compare our results to those of the top performing nations. We are considering requesting inclusion the 2011 administration of TIMSS, which would require a commitment in 2009 and funding in the 2010-12 biennial budget, which will be submitted during Governor Kaine's term.

The National Data Quality Campaign has identified 10 essential elements of an individual student identifier, longitudinal state data system that can track individual student data in all content areas (including STEM) from P-12 into the postsecondary system. How many of these elements does your state's data system have at present, and what are the plans to continue development?

Virginia's Status

1. A unique statewide student identifier that connects student data across key databases across years - YES
2. Student-level enrollment, demographic and program participation information - YES
3. The ability to match individual students' test records from year to year to measure academic growth - YES
4. Information on untested students and the reasons they were not tested - YES
5. A teacher identifier system with the ability to match teachers to students - YES
6. Student-level transcript information, including information on courses completed and grades earned - NO
7. Student-level college readiness test scores - YES
8. Student-level graduation and dropout data - YES
9. The ability to match student records between the P-12 and higher education systems - NO
10. A state data audit system assessing data quality, validity and reliability - YES

Virginia is working toward Elements 8 and 9. The Board of Education recently approved revisions to the *Regulations Governing the High School Transcript* which allow for an electronic transcript that can be transmitted from school-to-school and from school-to-higher education. The unique student identifier is a required element of the transcript's content, allowing higher education institutions to capture it in their records. The identifier can be used to match student records between P-12 and higher education systems. Plans are also underway to add course-level data to the information system.

b) Are the state's standards for K-12 STEM teacher knowledge and skills aligned with the state's learning standards in STEM areas for students?

The state academic standards, the *Standards of Learning*, were used explicitly in developing the licensure standards, and the two documents are completely aligned. All STEM-related teaching endorsements are based on and directly reference the academic standards.

For example, for the high school Chemistry teaching endorsement (8VAC 20-21-380) found in the *Virginia Licensure Regulations for School Personnel* (<http://www.doe.virginia.gov/VDOE/Compliance/TeacherED/nulicvr.pdf>) states:

- A. The program in chemistry will ensure that the candidate demonstrates the following competencies:
1. Understanding of the knowledge, skills, and processes of the four core science disciplines as defined in the *Virginia Science Standards of Learning* and how they provide a sound foundation for teaching chemistry.
 3. Understanding of the knowledge, skills, and processes for teaching laboratory science, including the ability to:
 - a. Design instruction reflecting the goals of the *Virginia Science Standards of Learning*; (italics added)

State standards for K-12 CTE teacher knowledge and skills align with state learning standards for students.

c) How many new K-12 teachers with certification in STEM areas does the state produce each year?

Please refer to the charts below outlining the program completers from Virginia teacher preparation programs and the endorsements issued on Eligibility Licenses for individuals completing Career Switcher Programs.

How many of these new STEM teachers found employment in the state?

Program Completers in STEM Areas from Approved Programs in Virginia Colleges and Universities									
September 1, 2005, to August 31, 2006									
College/University	Middle School 6-8*	Computer Science	Mathematics	Mathematics - Algebra I	Science - Biology	Science - Chemistry	Science - Earth Science	Science - Physics	Career and Technical Education: Technology Education
Averett University					2				
Bluefield College			1						
Bridgewater College			1		1				
Christopher Newport University			2		2				
College of William and Mary			2		4	2			
Eastern Mennonite University			3			1			
Emory and Henry College	10	1	2	1	1				
Ferrum College									
George Mason University			9		8	2	2	1	
Hampton University									
Hollins University			2		1				
James Madison University	13		11	4	1	1	2		
Liberty University	8								
Longwood University	1				1				
Lynchburg College									
Mary Baldwin College	14					1			
Marymount University		2	3				1		
Norfolk State University			3						
Old Dominion University	11		5		3	1	8	1	13
Radford University	11		2		1				
Randolph-Macon College					1	1			
Randolph-Macon Woman's College			1						
Regent University									

Program Completers in STEM Areas from Approved Programs in Virginia Colleges and Universities									
September 1, 2005, to August 31, 2006									
College/University	Middle School 6-8*	Computer Science	Mathematics	Mathematics - Algebra I	Science - Biology	Science - Chemistry	Science - Earth Science	Science - Physics	Career and Technical Education: Technology Education
Roanoke College			3	1		1			
Saint Paul's College									
Shenandoah University	2								
Sweet Briar College								1	
University of Mary Washington			2			1			
University of Mary Washington – College of Graduate and Professional Studies	1				2				
University of Richmond			3		2			1	
University of Virginia			10	2	3	6	6	1	
University of Virginia's College at Wise			1	3	3		3		
Virginia Commonwealth University	10		1		5	2			
Virginia Intermont College									
Virginia State University		1	1						
Virginia Tech			16		8	1	1	2	1
Virginia Union University									
Virginia Wesleyan College			1		1				
TOTALS	73*	4	85	11	50	20	23	7	14

* The middle school endorsement requires two areas of concentration. These numbers include program completers with middle education endorsements with concentrations that may include any of the four areas of English, mathematics, science, history and social science.

NUMBER OF ENDORSEMENTS IN STEM AREAS ISSUED ON ELIGIBILITY LICENSES FOR CAREER SWITCHERS										
July 1, 2005, to June 30, 2006										
Computer Science	Mathematics	Mathematics – Algebra I	Middle School Mathematics	Middle School Science	Science - Biology	Science – Chemistry	Science – Earth Science	Science - Physics	Career and Technical Education: Technology Education	TOTAL
17	44	7	42	32	42	22	20	18	2	246

- d) How does the state hold providers of K-12 STEM teacher preparation accountable for producing the quality and quality of STEM teachers the state needs? Are there promising new models of recruiting and preparing STEM teachers?

Teacher Preparation Programs - Quality and Accountability in Virginia

In Virginia, approved programs and licensure in teacher education are viewed as the cooperative responsibility of institutions of higher education, local school divisions, and the Virginia Department of Education. Although responsibility ultimately rests with the Virginia Board of Education, this collective effort encourages the development and operation of diverse teacher education programs throughout the Commonwealth.

Teacher preparation programs are monitored by the Virginia Department of Education through annual reports and a seven-year on-site review process. The state program approval process, which began in 1968, now includes the submission of an institutional report as well as an on-site review of supporting evidence that is conducted by a trained team of educators.

Presently, of the 37 teacher preparation programs in Virginia, 15 are accredited by the National Council for Accreditation of Teacher Education (NCATE). One institution holds accreditation from the Teacher Education Accreditation Council (TEAC), and nine institutions are considering TEAC as an option. The remaining institutions complete a Board of Education process.

At its March 29, 2007, meeting, the Board of Education approved proposed *Regulations Governing the Review and Approval of Education Programs in Virginia*. The current regulations that became effective in July 2001 will be repealed, and new regulations will be promulgated by the Board of Education upon completion of the Administrative Process Act.

The new regulations will include the following accountability measures:

Standards for Biennial Approval of Education Programs in Virginia

Approved education programs in Virginia shall have national accreditation or be accredited by a process approved by the Board of Education and demonstrate achievement biennially of the following accountability measures:

1. Candidate progress and performance on prescribed Board of Education licensure assessments; Candidate passing rates, reported by percentages, shall not fall below 70% biennially for individuals completing and exiting the program. Achievement of an 80% biennial passing rate shall be required by July 1, 2010. Candidates completing a program shall have successfully completed all coursework, required assessments, including those prescribed by the Board of Education, and supervised student teaching or internship. Candidates exiting a program shall have successfully completed all coursework, regardless of whether the individuals attempted, passed, or failed required assessments, including those prescribed by the Board of Education, and/or who may not have completed supervised student teaching or required internship.
2. Candidate progress and performance on an assessment of basic skills as prescribed by the Board of Education for individuals seeking entry into an approved education preparation program. Indicators of the achievement of this standard shall include the following:
 - results on Board of Education prescribed entry-level assessments; and
 - documentation that candidates enrolled in the program who fail to achieve a minimum score established by the board of Education have the opportunity to address any deficiencies;
3. Structured and integrated field experiences to include directed student teaching requirements;
4. Evidence of opportunities for candidates to participate in diverse school settings that provide experiences with populations that include racial, economic, linguistic, and ethnic diversity throughout the program experiences.
5. Evidence of contributions to pre-k-12 student achievement by candidates completing the program;
6. Evidence of employer job satisfaction with candidates completing the program; and
7. Partnerships and collaborations based on pre-k-12 school needs.

Promising Models of Preparing and Recruiting STEM Teachers

- See Section 2g for descriptions of Middle School Teacher Corps, Mentoring for Hard-to-Staff Schools Program, Virginia Teaching Scholarship Loan Program; Electronic Job Bank and Hiring Hall; and Virginia's Special Education Improvement Plan II: Institutes of Higher Education Partnership with Local Education Agencies Project

- e) How is the state supporting effective use of available state and federal funds for high quality professional development for STEM teachers? Who are the providers of professional development in the state and how does the state evaluate those providers?

The state supports effective use of state and federal funds for high-quality professional development. Since 2003 the Mathematics and Science Partnership (MSP) Grant has funded 25 projects that provide high-quality professional development in mathematics and science to K-12 teachers. The chart attached at the end of this document, “Mathematics and Science Partnerships Grants (Years 1-3),” shows the first 16 programs funded. The remaining 9 projects for will be funded in 2007.

Needs in K-12 mathematics and science are determined through data collection, and priority areas are set. The priority areas are announced in a request for proposals (RFP). Institutions of higher education partner with local school divisions to develop plans that meet the needs of the schools around the priority area. Priority areas are delineated in the accompanying table labeled “Mathematics and Science Partnership Priority Areas.”

Each project is required to have an outside evaluator and submits an evaluation at the completion of the project.

- f) Does the state support incentives, including performance-based, differentiated compensation, to recruit and retain effective STEM teachers? How does the state specifically help low-income, high-minority, low-performing, and hard-to-staff schools recruit and retain effective STEM teachers? How well are any incentives working, and what is the evidence for that conclusion?

The state has implemented several incentive-based programs designed to assist hard-to-staff schools in the recruitment and retention of highly qualified and effective teachers. Mathematics, science, and technology education are three of the critical shortage areas that are included in these initiatives.

Teacher Incentives for Hard-to-Staff Schools – This pilot project is designed to improve student achievement in hard-to-staff schools by attracting and retaining licensed, highly qualified, and experienced teachers. The program offers incentives to: 1) attract and retain high quality, experienced teachers; 2) provide training to existing teachers in the school to improve student achievement; 3) support new teachers through the implementation of a research-based mentoring program; and 4) provide support for an improved environment for teaching and learning.

The state has supported the hard-to-staff incentive pilot program for five school divisions over the last three years. Caroline County and Franklin City were the initial pilot sites beginning in the 2004-2005 school year. The program was expanded to include Petersburg City, Greensville County, and Brunswick County for the 2005-2006 school year. The divisions were selected based on student achievement, poverty, and teacher recruitment and retention indicators. Key elements of the program are:

- Signing bonuses for highly qualified and effective teachers, particularly in hard-to-fill positions;
- Retention bonuses for highly effective teachers;
- Stipends for participation in research-based, high quality professional development for all teachers and staff;
- Implementation of high quality new teacher mentoring programs; and
- Incentive funding for the improvement of working conditions.

Results: Over the three year period, 45 hiring bonuses have been offered. Approximately ten of these were for mathematics teachers. Retention bonuses have been paid to a total of 376 teachers. The training stipend for participation in professional development activities was paid to 1,243 teachers.

Caroline County reports that there are only two teachers who have indicated an intention to leave the county at the end of the school year compared to 60 prior to the implementation of the program.

The Virginia Middle School Teacher Corps – This program is designed to improve the quality of mathematics instruction in middle schools and ensure that students receive a solid foundation in mathematics as they prepare to enter high school. The program provides the structure and incentives for school divisions to hire experienced mathematics teachers for middle schools that have been designated as "at risk in mathematics" and focuses on narrowing the achievement gap by offering high quality training and support for all teachers in the division and offering incentives to highly qualified, experienced teachers to relocate or remain in one of the designated low-performing schools. Furthermore, the program has been designed to encourage participating divisions to build capacity to continue the program after the initial implementation period. Teachers chosen to serve as Teacher Corps members must meet stringent criteria for improving student achievement in the area of mathematics while working in challenging environments.

Results: There were 18 Teacher Corps members placed into 15 eligible schools during the 2005-2006 school year. Five (5) additional Teacher Corps members were placed in four (4) eligible schools during the 2006-2007 school year. It is anticipated that a larger number of schools will be eligible for participation in the program during the 2007-2008 school year since required statewide assessments in mathematics have been expanded to include 6th and 7th grades. During the first year of statewide testing in 6th and 7th grade mathematics, scores at the middle school level decreased from a statewide average of 84 percent passing to 76 percent passing. As a result, additional training and support is being targeted to mathematics teachers at the 6th and 7th grade levels, including expansion of the Teacher Corps program.

The Virginia Teaching Scholarship Loan Program (VTSLP) – This program provides financial support to students who are preparing to teach in one of Virginia's critical shortage teaching areas. The critical shortage teaching areas are determined annually through the Supply and Demand Survey of Administrative and Instructional Personnel, which is completed annually and submitted to the Virginia Department of Education. Shortages in specific subject areas are derived from the top ten academic disciplines identified by the survey as shortage fields. Mathematics, science, and either technology education or computer science have been designated as critical shortage areas each year since 2003-2004. Through the VTSLP, eligible students may receive a scholarship-loan for as much as \$3,720. When the student completes his/her teacher preparation program, the scholarship-loan may be totally forgiven if the student teaches for four semesters in the public schools of Virginia in the critical shortage field.

Results: A total of 102 mathematics teachers, 36 science teachers, and 12 computer science or technology education teachers have received scholarships over the last four years.

Priority Funding for Teachers Seeking National Board Certification – Legislative appropriation provides \$1,000 of the application fee for 75 candidates each year. Candidates receiving this funding are selected randomly; however, priority is given to teachers from hard-to-staff schools. Virginia also received a grant from the U.S. Department of Education to assist in funding application fees. There are currently 362 Nationally Board Certified candidates who were awarded either a \$2,000 or a \$1,000 federal or state subsidy grant for the 2005-2006 process. In addition, several Virginia school divisions are providing full or partial fee payment for approximately 50 candidates.

The National Teacher Certification Incentive Reward Program and Fund, administered by the Virginia Department of Education, provides incentive grants to public school teachers achieving National Board Certification, and, to the extent that funds are available, an initial award not to exceed \$5,000 with a subsequent annual award of \$2,500 for the life the certificate.

Of the 1,137 National Board Certified teachers in Virginia, 87 have received a mathematics certification and 103 have been certified in science.

Additional Programs for Hard-to-Staff Schools

Career Switcher Alternative Route to Licensure Program – This program was developed as an alternative pathway to teaching for individuals who have not completed a teacher preparation curriculum but have considerable life experiences, career achievements, and academic backgrounds that are relevant for teaching in pre-K through grade 12. Priority is given to applicants eligible to teach in critical shortage areas such as mathematics, foreign languages, science, and technology education. Virginia has nine program providers.

Results: In the first five years of implementation, the program has issued eligibility licenses to over 800 career switchers.

Hard-to-Staff Mentoring – While the Virginia General Assembly provides funding for all school divisions to assist with new teacher mentoring efforts, in 2004, the General Assembly appropriated additional funds for mentoring programs to assist schools designated as hard-to-staff. To receive the additional funding, school divisions submitted proposals for mentoring programs in the designated hard-to-staff school(s). The proposals were to be aligned with the *Virginia Requirements of Quality and Effectiveness for Beginning Teacher Mentor Programs in Hard-To-Staff Schools*.

Results: One hundred seventy-five (175) schools were designated as hard-to-staff for the 2006-2007 school year and were eligible for the funding.

Improving Teacher and Principal Quality State Grants – These competitive grants are administered by the State Council of Higher Education in Virginia (SCHEV). Each project must include partnerships between universities and at least one high needs school division to be eligible for funding. Among the grants funded for the 2005-2006 school year related to science, mathematics, or technology were the following:

- “Supporting Teacher Advancement through Robotics (STAR)” – The College of William and Mary is providing coursework and on-site support to teachers in Accomack County and Portsmouth City Schools.
- “Foundational Physics for Middle Level Science Teachers” – George Mason University is providing training and support to middle and high school teachers in Fairfax, Manassas City, Alexandria, and Arlington.
- “Project TILDA: Teaching, Learning and Integrating in a Digital Age” – Hampton University is providing coursework in core content integrated with technology for 40 teachers in Hampton City.
- GRASP 2: GIS/GPS Related Activities for Student Progress” – James Madison University is providing training to 52 teacher leaders in Central Virginia, Southside Virginia, and the Shenandoah Valley.

- “Earth Science, Elementary Science, Mathematics, and Reading” – Radford University is providing coursework and support to 40 teachers in Southside and Southwest Virginia.
- “Inquiry Approaches to Math and Science: Grades 3-8” – Sweet Briar College is providing coursework and follow-up support for 266 participants in surrounding school divisions.
- “Physical Science and Physics Courses for K-12 Teachers”- The University of Virginia is providing coursework to teachers in school divisions in Central Virginia and the Shenandoah Valley.

g) Does the state have effective intermediate capacity (e.g. STEM centers, the state department of education, postsecondary institutions, the business community, the philanthropic sector, museums) to support districts and schools in delivering improved STEM teaching and learning across the state? What is the focus of this intermediate capacity (e.g. alignment, policy, implementation)? Are there effective public-private partnerships at this intermediate level?

Virginia has an effective informal network of colleges and universities, businesses, private foundations, and public and private centers and museums that contribute to support school divisions in delivering improved STEM teaching and learning. State resource agencies including the Departments of Environmental Quality, Game and Inland Fisheries, Forestry, Conservation and Recreation, Agriculture, contribute substantially to the network with strong educational missions. These agencies work closely with the Department of Education to provide professional development and teaching resources for targeted areas of the state standards.

The Department of Energy-funded Jefferson Lab, Dahlgren Naval Surface Warfare Center, and NASA-Langley Research Center and Wallops Island Flight Facility provide extensive educational programming in collaboration with school divisions.

Virginia’s public and private colleges and universities work closely with school divisions and the Department of Education in numerous grant-funded projects as well as providing coursework accessible to in-service teachers. The majority of Virginia public colleges and universities participate in the Mathematics and Science Partnership grants or the state’s higher education NCLB grants, which have significant mathematics, science, and engineering teacher-training projects.

State museums including the Museum of Natural History and the Science Museum of Virginia (<http://www.smv.org/>) have a strong statewide presence and a substantial staffs that provide services to educators in school divisions and on site. School programs reach thousands of students directly, and teachers are served by numerous experiential professional development opportunities. Private museums including the Virginia Living History Museum and the Mariners Museum also collaborate with school personnel to offer curriculum enrichment.

Several local school divisions have STEM centers. For example, Halifax County has a STEM Center, Chesapeake City Public Schools operates a Center for Science and Technology, and Fairfax County has the Thomas Jefferson High School for Science and Technology.

Local collaborative efforts to support STEM education, such as the central Virginia regional Mathematics and Science Center, (<http://www.mathsciencecenter.info/index.html>) provide high quality services to school divisions directly. The state does not catalog all of the various local efforts and partnerships for STEM education.

- h) Is the data on student achievement and attainment in K-12 STEM education widely available, and if so, how? Does the state have a plan to communicate the importance of STEM education redesign to the state's economic future to these key stakeholders?

Student achievement in general is reported through school, division and state report cards, available on the Department of Education web site. Standards of Learning test results are listed by grade level and disaggregated by subgroup. The report cards also list the number of industry-recognized credentials attained by students, as well as participation in college-level coursework and Advanced Placement testing. In addition, CTE attainment data are available for grades 6-12 through the Career and Technical Education Reporting System (CTERS). Research is currently being conducted to determine the most effective means for communicating the importance of the redesign of STEM education statewide.

- i) Are there public-private partnerships supporting informal STEM education outside the K-12 school system (expanded learning opportunities, museum work, etc.) that helps develop and maintain student interest in STEM areas at early ages? Are these out-of school STEM education efforts connected to the STEM standards, assessments, and curricula in the schools?

There are examples of public-private partnerships that provide STEM and related professional development to teachers and educational services to students. One long-standing example is state funding to the Chesapeake Bay Foundation to provide estuarine ecology experiences to students to enhance their knowledge of Virginia's unique environment and the science, technology, and policy behind resource protection and use. There are numerous examples of local public-private partnerships. Private funding supports many of the activities of state and local museums and science centers.

State agencies, museums, private foundations, and other partners use state STEM standards to develop and target their programs.

Expanded learning opportunities are also available through Career and Technical Student Organizations, FIRST, VEX, and Lego League Robotics, NASA education resources, Math Counts, Infinity Project, JETS, Destination Imagination, and other partnerships. Career and Technical Student Organizations are connected through standards and curriculum frameworks such as the International Technology Education Association (ITEA) Standards for Technological Literacy, which were reviewed by the National Academy of Engineering. The National Science Foundation funded a project to the Technology Student Association that focused on strengthening STEM experiences through the use of standards-based assessments for robotics competitions.

3. IDENTIFY EMERGING BEST PRACTICE STEM EDUCATION MODELS, EVALUATE NEW APPROACHES, AND BRING PROVEN MODELS TO SCALE

- a) What types of STEM focused school options (state funded STEM academies, charter schools, in-district magnet schools, early college high schools) do students in the state currently have? What percentage of the public school population do these schools enroll and graduate? What is the demographic (e.g. race, ethnicity, socio-economic status) profile of students enrolled in and graduating from these schools? How many of these options exist? Has the state assessed the demand and potential supply for additional STEM focused school options?

All public schools receive a certain level of state funding and many locally-developed programs are STEM focused, though the state does not systematically collect that information.

The majority of the Virginia Governor's Schools are STEM focused. Approximately 5,800 high school students (about 1.5% of all high school students) are enrolled academic-year Governor's Schools, which may be for grades 9-12 or 11-12. The schools that concentrate on one or more STEM areas exclusively are:

- | | |
|---|---------------------------|
| 1. A. Linwood Holton GS | 9. Mountain Vista |
| 2. Appomattox RGS (Arts and Technology) | 10. New Horizons GS |
| 3. Blue Ridge GS | 11. Piedmont GS |
| 4. Central Virginia GS | 12. Roanoke Valley GS |
| 5. Chesapeake Bay GS | 13. Shenandoah Valley GS |
| 6. Governor's School for Southside Virginia | 14. Southwest Virginia GS |
| 7. Jackson River GS | 15. Thomas Jefferson HS |
| 8. Massanutten GS | |

A sample of other schools in the state that are STEM focused are:

- Science, Mathematics, and Technology Specialty Center, Mills E. Godwin High School, Henrico County Public Schools
- Center for Environmental and Natural Sciences, Freedom High School
- Center for Biotechnology, Osbourne Park High School, Prince William County Public Schools
- Mathematics and Science Specialty Center, Clover Hill High School, Chesterfield County Public Schools
- Pre-Engineering Specialty Center, L. C. Bird High School, Chesterfield County Public Schools
- Mathematics and Science Academy, Ocean Lakes High School, Virginia Beach City Public Schools, Virginia Beach City Public Schools

b) Please describe some schools or programs in the state that are especially effective in graduating students from high school prepared in STEM competencies for college. What is the evidence for their success? Are these programs serving all student groups? Does the state plan to support the expansion of these models?

The Governor's Schools are particularly effective in preparing students for STEM competencies. On example from this group, Thomas Jefferson High School for Science and Technology is internationally known for the successes of its programs and students. Established in 1985, Thomas Jefferson High School for Science and Technology (TJHS) is the result of a partnership of businesses and schools created to improve education in science, mathematics, and technology. Representatives from business and industry and school division staff worked together in curriculum and facilities development for the school. In recent years, local business leaders and Jefferson parents have formed the Jefferson Partnership Fund to help raise money to maintain and equip labs and classrooms in the school. Thomas Jefferson serves students from Arlington, Fairfax, Fauquier, Loudoun, and Prince William Counties as well as the cities of Fairfax and Falls Church. **TJHS has been selected as a finalist for the Intel Schools of Distinction Award in the Mathematics category this year.**

Students are selected to the Governor's Schools by application. Statewide, Governor's Schools currently serve all but a very small number of school divisions.

- c) Please describe some career technical education (CTE) programs in the state that offer students rigorous and relevant pathways into STEM related occupations (e.g. programs resulting in industry certification). What is the evidence for their success? Does the state plan to support the expansion of these models?

See attached Course Sequences, and sample secondary to postsecondary career pathways for information systems technology/interactive media at the end of this document. Several courses in the Engineering and Biotechnology sequences are Project Lead the Way courses.

The Virginia Career and Technical Education Reporting System provides follow-up information on all program success. These data are reported to the USED in response to required Performance Standards under the Carl D. Perkins Act of 1998 and will be continued under the Carl D. Perkins Career and Technical Education Act of 2006. Support for expansion of these courses and models will be reviewed in the writing of the five-year state plan for Carl D. Perkins Career and Technical Education Act of 2006.

- d) Does the state have required and/or voluntary technology and engineering standards, assessments, and/or curricula in place at the K-8 level or high school level? Is the state supporting the expansion of emerging successful models in these areas (e.g. Project Lead the Way)? Are these models engaging students in these disciplines at early grade levels as well as maintaining that interest later? Are these models open to all students?

Virginia's Technology Education curricula are correlated to the International Technology Education Association (ITEA) Standards for Technological Literacy. Possible standards for engineering education are being studied by the National Center for Engineering and Technology Education, and recommendations regarding standards for engineering in education are being studied by the National Academy of Engineering. Curricula being used to address STEM education in K-8 include: Children's Engineering, Introduction to Technology, Inventions and Innovations, and Technological Systems. These programs are open to all students. Curricula being used to address STEM education at the high school level include Project Lead the Way and The Infinity Project. In addition, four school divisions have implemented Exemplary Standards based on work from the National CTE Dissemination Center. Virginia is targeting expansion of the Exemplary Standards program into a statewide incentive program to raise the quality of career and technical education as a postsecondary-readiness pathway for all students.

- e) How is the state supporting the expansion of college-level learning opportunities for high school students (e.g., Advanced Placement (AP), International Baccalaureate (IB), early college high schools) in STEM areas? What is the evidence for the success of these approaches? Are these opportunities available for all students?

The state is supporting the expansion of college-level learning opportunities through several programs.

1. Through grants made available to all school divisions, the state supports AP and IB testing reimbursement for economically disadvantaged students. For 2006-2007 over \$255,000 was available through a USED grant the state applied for and received. One hundred and twenty-one school divisions received grants for 4,820 tests.
2. The Early College Scholars Program allows students with a B average or better to receive college credit for high school courses so that students can transfer up to 15 credits to college. This is true for courses in the STEM areas, particularly science and mathematics.

3. The Commonwealth College Course Collaborative (CCCC) is a common set of college level coursework taken in high school that will transfer as area or major requirements - not just elective credits, provided students meet certain scoring requirements. These are accepted by every public college in Virginia (except VMI), as well as the 24 undergraduate private institutions that make up the Council of Independent Colleges in Virginia.
4. Virtual Virginia, which includes the Virginia Virtual Advanced Placement School, provides a variety of Advanced Placement (AP) courses, enabling students to earn college credit, regardless of their high school's ability to offer college-level courses. In 2004 there were approximately 250 students enrolled. In 2006, there are over 2000 students enrolled in 20 different AP courses offered on a full-year and semester-block basis. These are taught in 110 of Virginia's 132 school divisions. Students enrolled as Early College Scholars have their Virtual Advanced Placement School tuition and AP test fees provided by the state

The latest AP report shows a significant increase in the numbers of students taking AP courses and exams, and the high percent of students receiving 3's and 4's on the exams in the STEM fields. Virginia has joined a select handful of states in which 20 percent or more of high school seniors earned a grade of 3 or more on an Advanced Placement (AP) examination, the College Board said in its third annual Advanced Placement Report to the Nation. Last year, 20.7 percent of the Commonwealth's public high school seniors earned a grade of 3 or better on at least one AP exam, compared with 19.3 in 2005, and 15.9 percent in 2000. Only three states, New York, Maryland, and Utah, had a higher percentage of seniors earning grades of 3 or better on AP tests during 2006. The national average was 14.8 percent.

The 2007 *AP Report to the Nation* contains the disaggregated statistics.
(http://www.collegeboard.com/prod_downloads/about/news_info/ap/2007/2007_ap-report-nation.pdf)

In addition to the aforementioned efforts, The Virginia Department of Education is a supporting partner in a grant proposal to the National Mathematics and Science Initiative. The grant is being submitted by the Southern Virginia Higher Education Center, the Institute for Advanced Learning and Research, and the New College Institute for the Commonwealth. The purpose of that grant is to fund the advancement of pre-AP and AP mathematics, science and English programs across the state.

- f) Are there state programs designed to help low-performing students in STEM areas meet the state standards and course requirements? How are low-performing students targeted and supported? What evidence does the state have these strategies are working?

There are several programs provided by the state designed to help low-performing students achieve. This is especially true in mathematics. The programs are:

1. Algebra Readiness Initiative;
2. Virginia Online Algebra I Tutorial;
3. Virginia Online Geometry Tutorial; and
4. Project graduation.

For these particular programs students are targeted by the localities using poor performance in classes, and failing scores on *Standards of Learning* tests. Students are supported in each of the programs through methods that pre-test the students to diagnose individual weaknesses, followed by intense instruction to target those weaknesses. Post-tests and frequent monitoring of student progress occurs within each of the aforementioned programs.

Evidence of success can be found in the improvement rate on the Algebra 1 end-of-course test as follows:

- The statewide Algebra I end-of-course passing rate for all students rose from 75 percent in 2001-2002 to 88 percent in 2005-2006, which represents a 13-point gain overall.
- Using 2001-2002, the first year of the Algebra Readiness Initiative, as the baseline, this increase represents the greatest gain of any single SOL end-of-course test with the exceptions of U.S. and Virginia History and Earth Science.
- The greatest gains in the Algebra I end-of-course passing rates have been with students with disabilities and black students. Since 2001-2002, the passing rate of students with disabilities has increased by 22 points and the passing rate of black students has increased by 20 points.

Algebra I SOL End-of-Course Pass Rates: 2002-2006						
Subgroup	2002	2003	2004	2005	2006	Change 2002-2006
All Students	75	79	82	86	88	13
Black Students	61	66	72	78	81	20
Hispanic Students	70	72	73	81	83	13
White Students	81	83	86	90	90	9
Limited English Proficient Students	75	74	74	83	84	9
Students Identified as Disadvantaged	64	69	74	79	81	17
Students with Disabilities	45	49	53	63	67	22
Female Students	77	81	84	88	89	12
Male Students	74	77	80	84	86	12

- The 2005-2006 Algebra I end-of-course passing rates disaggregated by grade range (6-8 vs. 9-12) are shown in the table below. The 2005-2006 statewide passing rate for middle school students is 98 percent compared to 83 percent for high school students.

2005-2006 Algebra I SOL End-of-Course Pass Rates				
Grade Range	Number Proficient	Number Advanced	Number Fail	Pass Rate
6-8	15,926	13,009	462	98
9-12	54,066	6,346	12,045	83
All Students	69,993	19,360	12,507	88

The Virginia Online Geometry Tutorial is a new program and data quantifying its impact is not available at this time.

Attachment for Item 2(f)

Mathematics & Science Partnerships Grants (Years 1-3)

Grant Title	Institution	Partners—LEAs Universities & NPOs	Content Area	Grade Level
Year 3 (3/2006-9/2007)				
A Partnership Project: Building Innovative Distance Learning Mathematics Courses for High School Teachers	University of Virginia	Bristol City, Roanoke City, Salem City	Mathematics	High School
Mathematics & Science Partnership – High School Mathematics	James Madison University	Caroline, Huguenot High, George Wythe High School, King George, Spotsylvania, Stafford, Waynesboro High School, Colonial Beach JMU, Mary Washington	Mathematics	High School
The Algebra and Geometry for All (ALGEA) Project	Christopher Newport University	Newport News, Hampton City	Mathematics	High School
Coalfield County Math Science Partnership (CCMSP)	UVA Wise, Center for Teaching Excellence (CTE)	Russell, Tazewell, Scott, Norton City, Dickenson, Buchanan, Wise Appalachian Math Science Partnership	Mathematics	Grades 6-8

Grant Title	Institution	Partners—LEAs Universities & NPOs	Content Area	Grade Level
Year 3 (3/2006-9/2007)				
Math & Science Inquiry Needed for Data Analysis through Technology Wise-use and Integration by Students and Teachers (MINDTWIST)	Longwood University	Brunswick, Charlotte, Lunenburg, Nottoway, Cumberland, Halifax, Prince Edward	Science & Mathematics	Grades 4-8
Science SOLutions	Danville Science Center	Danville, Floyd, Halifax, Henry, Martinsville, Montgomery, Pittsylvania Averett University, Institute for Advanced Learning and Research	Science	Grades 6-12
Helping Our Pupils Excel (HOPE) in Science	Petersburg	Petersburg Mathematics & Science Center, Virginia State University	Science	Grades 4-8
Carver Academy of Science Professional Learning Community Project	Richmond City	Carver Elementary Virginia Commonwealth University, Science Museum of Virginia	Science	K-5
Algebra I Success for "ALL" Students	Westmoreland County	Westmoreland County Old Dominion University, Rappahannock Community College	Mathematics	High School

Grant Title	Institution	Partners—LEAs Universities & NPOs	Content Area	Grade Level
Year 2				
Tidewater Team for Improved Middle School Mathematics	College of William and Mary	Charles City, Dinwiddie, Franklin, Gloucester, Hampton, Hopewell, Isle of Wight, King and Queen, King William, Lancaster, Mathews, Middlesex, New Kent, Newport News, Norfolk, Northumberland, Petersburg, Poquoson, Portsmouth, Prince George, Southampton, Suffolk, Surry, Sussex, Walsingham Academy, West Point, Williamsburg-James City, York College of William and Mary, Hampton University, Old Dominion University, Virginia State University	Mathematics	Grade 6-7
Preparing Highly Qualified Middle School Mathematics Teachers Across Virginia	University of Virginia	Albemarle, Amherst, Appomattox, Bedford, Bland, Bristol, Brunswick, Buchanan, Carroll, Charlotte, Charlottesville, Chesterfield, Colonial Heights, Cumberland, Danville, Fluvanna, Franklin, Galax, Grayson, Hanover, Henrico, Henry, King & Queen, King George, Lee, Louisa, Lunenburg, Mecklenburg, Northumberland, Nottoway, Orange, Pittsylvania, Powhatan, Prince Edward, Richmond City, Roanoke City, Rockbridge, Russell, Scott, Shenandoah, Smyth, Spotsylvania, Staunton, Tazewell, Washington, Westmoreland James Madison University, Longwood University, Radford University, University of Mary Washington, University of Virginia, Virginia Commonwealth University, Virginia Tech	Mathematics	Grades 6-7
Virginia Earth Science Collaborative: Developing Highly	Mathematics and Science Center	Albemarle, Alexandria City, Amelia, Amherst, Appomattox, Arlington, Augusta, Bedford, Bedford City, Bland, Bristol, Brunswick, Buchanan,	Science	High School

Qualified Teachers		<p>Buckingham, Buena Vista, Carroll, Charles City, Charlotte, Chesterfield, Colonial Heights, Covington, Craig, Cumberland, Danville, Dinwiddie, Frederick, Fredericksburg, Gloucester, Goochland, Greensville, Halifax, Hanover, Henrico, Henry, Highland, Hopewell, Isle of Wight, King & Queen, King William, Lee, Louisa, Lunenburg, Lynchburg, Manassas, Martinsville, Mecklenburg, New Kent, Newport News, Northumberland, Nottoway, Page, Petersburg, Pittsylvania, Poquoson, Powhatan, Prince Edward, Prince George, Prince William, Richmond City, Roanoke City, Rockbridge, Russell, Scott, Spotsylvania, Stafford, Surry, Sussex, Tazewell, Warren, West Point, Williamsburg-James City, Winchester, York</p> <p>College of William & Mary and Virginia Institute of Marine Sciences, George Mason University, James Madison University, Longwood University, Mathematics and Science Center, Radford University, Science Museum of Virginia, University of Virginia and its School of Continuing & Professional Studies, Virginia Commonwealth University</p>		
Innovative Teachers of Earth Science in Tidewater	Southeast Virginia Regional Consortium (Virginia Space Grant Consortium)	<p>Portsmouth, Chesapeake, Norfolk, Suffolk, Hampton City</p> <p>Norfolk State University, Old Dominion University, Virginia Wesleyan College, Virginia Space Grant Consortium</p>	Science	High School

Mathematics and Science Partnership Priority Areas

	Priority
Year One (2003-04)	In this competition, the department expects to fund approximately four MSP programs in the state that focus on increasing (1) the number of highly qualified mathematics teachers in middle schools, with particular focus on middle schools accredited with warning or provisionally accredited and/or (2) the number of individuals licensed to serve as a K-8 mathematics specialist as described in the proposed Virginia licensure regulations for the position.
Year Two (2004-05)	These will be awarded to support successful proposals that will provide programs and resources to increase (1) the number of highly qualified mathematics teachers in middle schools, with particular emphasis on sixth and seventh grades, and/or (2) the number of fully endorsed Earth Science teachers.
Year Three (2005-06)	The MSP grants will be awarded to support successful proposals that will provide programs and resources to offer high-quality professional development for (1) middle grades (4-8) mathematics and science teachers in priority schools, and (2) high school mathematics and science teachers in priority schools.
Year Four (2006-07)	Programs must address one of the following areas: <ul style="list-style-type: none"> • sixth- and seventh-grade mathematics; and/or • elementary science.

Course Sequences

Design and Technology

Technology Foundations 8403
Technology Foundations 8402
Technology Transfer 8405
Technology Transfer 8404
Technology Assessment 8407
Technology Assessment 8406

Concentration Sequences	Specialization Sequences	Career Cluster
Technology Foundations 8403 and one of the following: <ul style="list-style-type: none"> Technology Transfer 8405 Technology Assessment 8407 	<ul style="list-style-type: none"> Technology Foundations 8403 Technology Transfer 8405 Technology Assessment 8407 	Science, Technology, Engineering, and Mathematics

Engineering, Option 1

Introduction to Engineering 8490
Advanced Engineering 8491

Concentration Sequences	Specialization Sequences	Career Cluster
<ul style="list-style-type: none"> Introduction to Engineering 8490 Advanced Engineering 8491 	Introduction to Engineering 8490 and Advanced Engineering 8491 and one course from the following programs: <ul style="list-style-type: none"> Design and Technology Program Communication and Information Technology Program Control Technology Program Production Technology Program Technical Design and Illustration Program Biotechnology Program 	Science, Technology, Engineering, and Mathematics

Engineering, Option 2

Principles of Engineering 8441
Introduction to Engineering Design 8439
Digital Electronics 8440
Computer Integrated Manufacturing 8442
Engineering Design and Development 8443

Concentration Sequences	Specialization Sequences	Career Cluster
<ul style="list-style-type: none"> Principles of Engineering 8441 Introduction to Engineering Design 8439 Digital Electronics 8440 	<ul style="list-style-type: none"> Principles of Engineering 8441 Introduction to Engineering Design 8439 Digital Electronics 8440 and one of the following courses: <ul style="list-style-type: none"> Computer Integrated Manufacturing 8442 Engineering Design and Development 8443 	Science, Technology, Engineering, and Mathematics

Communication and Information Technology

Computer Control and Automation 8421 (formerly Computing Systems)
Computer Control and Automation 8420 (formerly Computing Systems)

Concentration Sequences	Specialization Sequences	Career Cluster
Computer Control and Automation 8421 and one of the following: <ul style="list-style-type: none"> Communication Systems 8415 Graphic Communications Systems 8458 	Computer Control and Automation 8421 and two of the following: <ul style="list-style-type: none"> Communication Systems 8415 Electronics Systems 8416 Graphic Communication Systems 8458 Production Systems 8447 Manufacturing Systems 8425 	Information Technology

Communication Systems 8415
Communication Systems 8418

Concentration Sequences	Specialization Sequences	Career Cluster
Communication Systems 8415 and one of the following: <ul style="list-style-type: none"> Graphic Communications Systems 8458 Computer Control and Automation 8421 Geospatial Technology 8423 Imaging Technology 8455 	Communication Systems 8415 and two of the following: <ul style="list-style-type: none"> Computer Control and Automation 8421 Electronics Systems 8416 Geospatial Technology 8423 Graphic Communications Systems 8458 Imaging Technology 8455 	Information Technology

Graphic Communications Systems 8458
Graphic Communications Systems 8494

Concentration Sequences	Specialization Sequences	Career Cluster
Graphic Communication Systems 8458 and one of the following: <ul style="list-style-type: none"> Communication Systems 8415 Graphic Communications Systems 8458 Imaging Technology 8455 	Graphic Communications Systems 8458 and two of the following: <ul style="list-style-type: none"> Technology Foundations 8403 Communication Systems 8415 Computer Control and Automation 8421 Technology Foundations 8403 Imaging Technology 8455 Geospatial Technology 8423 	Arts, Audio-Video Technology and Communications

Geospatial Technology I

Concentration Sequences	Specialization Sequences	Career Cluster
Geospatial technology 8423 and one of the following courses: <ul style="list-style-type: none"> Communication Systems 8415 Imaging Technology 8455 	Geospatial Technology 8423 and two of the following courses: <ul style="list-style-type: none"> Communication Systems 8415 Imaging Technology 8455 Technology Foundations 8403 	Information Technology

Imaging Technology 8455

Concentration Sequences	Specialization Sequences	Career Cluster
Imaging Technology 8455 and one of the following courses: <ul style="list-style-type: none"> Communication Systems 8415 Geospatial Technology 8423 Video and Media Technology 8497 	Imaging Technology 8455 and two of the following courses: <ul style="list-style-type: none"> Communication Systems 8415 Geospatial Technology 8423 Graphic Communication Systems 8458 Video and Media Technology 8497 	Arts, Audio-Video Technology and Communications

Video and Media Technology 8497

Concentration Sequences	Specialization Sequences	Career Cluster
<ul style="list-style-type: none"> Video and Media Technology 8497 Communication Systems 8415 	<ul style="list-style-type: none"> Video and Media Technology 8497 Communication Systems 8415 Graphic Communications Systems 8458 	Arts, Audio-Video Technology and Communications

Control Technology

Electronics Systems I 8416 (36 weeks)
Electronics Systems I 8417 (18 weeks)
Electronics Systems II 8412
Electronics Systems III 8413

Concentration Sequences	Specialization Sequences	Career Cluster
<ul style="list-style-type: none"> Electronics Systems I 8416 Electronics Systems II 8412 	<ul style="list-style-type: none"> Electronics Systems I 8416 Electronics Systems II 8412 Electronics Systems III 8423 	Science, Technology, Engineering, and Mathematics

Power and Transportation 8445
Power and Transportation 8444
Energy and Power 8448
Energy and Power 8495

Concentration Sequences	Specialization Sequences	Career Cluster
<ul style="list-style-type: none"> Power and Transportation 8445 Energy and Power 8448 	<ul style="list-style-type: none"> Power and Transportation 8445 Energy and Power 8448 Electronics Systems I 8416 	Transportation, Distribution, and Logistics

Production Technology

Construction Technology 8431

Construction Technology 8432

Concentration Sequences	Specialization Sequences	Career Cluster
Construction Technology 8431 and one of the following: <ul style="list-style-type: none"> Production Systems 8447 Materials and Processes Technology 8433 Manufacturing Systems 8425 	Construction Technology 8431 and two of the following: <ul style="list-style-type: none"> Production Systems 8447 Manufacturing Systems 8425 Materials and Processes Technology 8433 	Architecture and Construction

Materials and Processes Technology 8433

Materials and Processes Technology 8478

Production Systems 8447

Production Systems 8446

Concentration Sequences	Specialization Sequences	Career Cluster
Materials and Processes Technology 8433 and one of the following courses: <ul style="list-style-type: none"> Production Systems 8447 Construction Technology 8431 Manufacturing Systems 8425 	Materials and Processes Technology 8433 and two of the following courses: <ul style="list-style-type: none"> Production Systems 8447 Construction Technology 8431 Manufacturing Systems 8425 Advanced Manufacturing Systems 8427 	Manufacturing

Manufacturing Systems 8425

Manufacturing Systems 8426

Advanced Manufacturing Systems 8427

Concentration Sequences	Specialization Sequences	Career Cluster
<ul style="list-style-type: none"> Manufacturing Systems 8425 Advanced Manufacturing Systems 8427 	Manufacturing Systems 8425 and Advanced Manufacturing Systems 8427 and one course from any of the following programs: <ul style="list-style-type: none"> Design and Technology Program Pre-Engineering Program Communication and Information Technology Program Control Technology program Production Technology Program Technical Design and Illustration Program Biotechnology Program 	Manufacturing

Information Technology in Production Systems 8496

Concentration Sequences	Specialization Sequences	Career Cluster
Information Technology in Production Systems 8496 and one of the following courses: <ul style="list-style-type: none"> Production Systems 8447 Construction Technology 8431 Manufacturing Systems 8425 Advanced Manufacturing Systems 8427 	Information Technology in Production Systems 8496 and two of the following courses: <ul style="list-style-type: none"> Production Systems 8447 Construction Technology 8431 Manufacturing Systems 8425 Advanced Manufacturing Systems 8427 Electronics Systems I 8416 Power and Transportation 8445 	Manufacturing

Technical Design and Illustration

Technical Drawing/Design 8435

Technical Drawing/Design 8434

Engineering Drawing/Design 8436

Engineering Drawing/Design 8493

Architectural Drawing/Design 8437
Architectural Drawing/Design 8492
Digital Visualization 8459

Concentration Sequences	Specialization Sequences	Career Cluster
Technical Drawing/Design 8435 and one of the following courses: <ul style="list-style-type: none"> Architectural Drawing/Design 8437 Engineering Drawing/Design 8436 Digital Visualization 8459 	Technical Drawing/Design 8435 and two of the following courses: <ul style="list-style-type: none"> Engineering Drawing/Design 8436 Architectural Drawing/Design 8437 Digital Visualization 8459 	<ul style="list-style-type: none"> Science, Technology, Engineering, and Mathematics Architecture and Construction (Architectural Drawing/Design only)

Principles of Technology

Principles of Technology I 9811
Principles of Technology II 9812

Note: Students who complete Principles of Technology I (9811) and Principles of Technology II (9812) may use these courses to satisfy one (1) physics credit in laboratory science.

Concentration Sequences	Specialization Sequences	Career Cluster
<ul style="list-style-type: none"> Principles of Technology I 9811 Principles of Technology II 9812 	N/A	Science, Technology, Engineering, and Mathematics

Biotechnology Program

Biotechnology Foundations 8468
Bioengineering 8467

Concentration Sequences	Specialization Sequences	Career Cluster
<ul style="list-style-type: none"> Biotechnology Foundations 8468 Bioengineering 8467 	<ul style="list-style-type: none"> Biotechnology Foundations 8468 Bioengineering Electronics Systems 8416 	Science, Technology, Engineering, and Mathematics



SAMPLE

April 16, 2007

VCCS/VDOE Statewide Articulation Agreement,
Options 1 and 2*



Career Cluster: Information Technology

Career Pathway: Interactive Media

Information Systems Technology (AAS)

Related Industry Certifications Available: See Supplemental Page

	Grade	English	Math	Science	S.S.	Required Courses or Recommended Electives and/or CTE Courses		
Middle School	7					Keyboarding (BUS6151)**		
	8					Digital Input Technologies (BUS6160) OR Computer Applications (BUS6611)		

CAREER ASSESSMENT: Administration of a career assessment instrument is appropriate at the middle school level to help students and their parents plan for high school (KUDER® or other assessment product).

	Grade	English	Math	Science	S.S.	Required Courses or Recommended Electives and/or CTE Courses			Related Careers
SECONDARY <i>Career Coaching</i>	9	English 9 1130	Algebra I 3130	Earth Science 4210	World History/ Geography 2219	Health & PE	Foreign Language	IT Fundamentals (6670) ^{1, 2}	<ul style="list-style-type: none"> • Animator • Audio-Video Engineer • Digital Media Designer • Graphic Designer • Media Specialist • Multimedia Author • Multimedia Developer • Multimedia Specialist • Page Developer • Producer • Production Assistant • Site Developer • Streaming Media Specialist • Virtual Reality Specialist • Web Architect/Designer • Web Designer • Web Development Administrator • Web Producer • Webmaster
	10	English 10 1140	Geometry 3143	Biology I 4310	World History/ Geography 2221	Health & PE	Foreign Language	Computer Information Systems (6612) ^{1, 2}	
	11	English 11 1150	Algebra II 3135	Chemistry 4410	US/VA History 2360		Foreign Language	Advanced Computer Information Systems (6615) ^{1, 2}	
	12	English 12 English 111/112 ²	Advanced Algebra and Trigonometry 3160	Physics OR Principles of Technology I (9811-Grades 10 or 11) and Principles of Technology II (9812-Grade 12)	US/VA Gov 2440			Design, Multimedia, and Web Technologies (6632) ^{1, 2}	

Postsecondary Placement Assessments (<i>Reading, Writing, & Math</i>)									
POSTSECONDARY Community College <i>Career Placement</i>	Year 1 1 st Semester	ENG 111 College Composition I ²	MTH 120 Introduction to Mathematics	SDV 100 College Success Skills	ACC 115 Applied Accounting I ^{2,4}	ITE 100 ¹ Introduction to Information Systems	ITN 100 Telecommunications	AST 114 Keyboarding for Information Processing ³	
	Year 1 2 nd Semester	ENG 112 College Composition II ²	BUS 125 Applied Business Mathematics	ITD 110 ^{1, 2}	ITD 130 ^{1, 2}	ITP 120 Java Programming I			
	Year 2 1 st Semester	AST 205 Business Communica- tions	BUS 220 Applied Business Statistics	ECO 120 Survey of Economics	ITE 221 ¹ PC Hardware & OS Architecture	ITD 210 ¹ Web Design II			
	Year 2 2 nd Semester	Social Science Elective	Health or Physical Education Elective	ITP 251 System Analysis and Design	Approved IT Elective	IT 298 Seminar and Project: Capstone Course			
4-year Institution	University/College:					Key	Required Course		⁴ Academic Dual Enrollment
	Degree or Major:						² Dual Credit or Articulated course (HS to CC)		
	Number of Articulated CC Credits:						³ Articulated course: CC to 4-yr		

¹Certification Prep Course.

²Dual Credit or Articulated course (High School to Community College).

³Articulated course: Community College to 4-year.

⁴Academic Dual Enrollment.

⁵Course code will depend on the type of Biology II offered.

⁶Course code will depend on the type of World History/Geography offered.

*Statewide Articulation Agreement is located at http://www.doe.virginia.gov/VDOE/Instruction/CTE/IT_Articulation_Agreement.pdf

****Note:** Dual enrollment or articulated credit may be received if the keyboarding course is taken at the high school level or if the course has been approved for high school credit even though offered at the middle school level. Students must have either taken a keyboarding course or must have tested out of the essential competencies keyboarding course to continue in the pathway.

CAREER PATHWAY SUPPLEMENTAL INFORMATION

Industry Certifications available upon completion of identified courses	Computer Applications 6611	Computer Information Systems (CIS) 6612 or Adv. CIS 6613	Design, Multimedia, or Web Technologies (DMTW) 6630 or Adv. DMTW 6631	Digital Input Technologies 6161	Information Technology Fundamentals 6670
Administrative Assisting Assessment (NOCTI)	X	X			
Adobe Certified Expert			X		
Brainbench Desktop Publishing Software Certifications		X			
Brainbench Software Development Certifications			X		
Brainbench Web Administration Certifications			X		
Brainbench Web Design and Development Certifications		X			
CIW Associate (Prosoft Learning)			X		
CIW Associate Certification: Internet Business Foundations Examination (Prosoft Learning)			X		
CIW Associate Certification: Network Technology Foundations Examination (Prosoft Learning)			X		
CIW Associate Certification: Site Development Foundations Examination (Prosoft Learning)			X		
CIW Professional (Prosoft Learning)			X		
IC ³ (Certiport)	X	X	X		X
International Computer Driving License (ICDL US)	X	X	X		
INet (CompTIA)			X		
IT Essentials, Level 1 (Cisco Systems)					
Macromedia Certified Professional			X		
Master CIW Designer (Prosoft Learning)			X		
Microsoft Office Specialist (MOS) Pass any one unique MOS exam at the core level—minimum requirement	X	X	X	X	
Web Design Certificate (Cisco Systems)			X		
WOW Certificate Apprentice Webmaster (World Organization of Webmasters)			X		
WOW Certified Web Administrator Apprentice (World Organization of Webmasters)			X		
WOW Certified Web Designer Apprentice (World Organization of Webmasters)			X		
WOW Certified Web Developer Apprentice (World Organization of Webmasters)			X		

CAREER PATHWAY SUPPLEMENTAL INFORMATION

TOPIC: Career-Technical Student Organization (FBLA) Related Activities	TOPIC: Work-Based Learning (Cooperative Education, Mentoring, Internships, Job Shadowing, and Service Learning)
<p>Future Business Leaders of America (FBLA) Related Activities:</p> <ul style="list-style-type: none"> • Business Communication • American Enterprise Project • Business Ethics • Business Knowledge and Skills • Business Plan • C++ Programming • Community Service Project • Computer Applications • Computer Concepts • Cyber Security • Database Design and Application • Desktop Publishing • Entrepreneurship • FBLA Principles and Procedures • Future Business Leader • Introduction to Business • Introduction to Business Communication • Introduction to Technology Concepts • JAVA Programming • Job Interview • Local Chapter Annual Business Report • Marketing • Multimedia Presentation • Network Design • Networking Concepts • Partnership with Business Project • Spreadsheet Applications • State Service Project • Technology Concepts • Virtual Business Challenge • Visual Basic Programming • Web Site Development • Word Processing I • Word Processing II 	<p><u>COOPERATIVE EDUCATION</u> Cooperative education is a method of instruction that combines career and technical classroom instruction with directly related paid employment. <i>The Career and Technical Education Cooperative Education Handbook</i> provides detailed information concerning development, regulations, teacher qualifications, and operation and management. Co-op is available through the following related courses in this pathway: Accounting; Advanced Computer Information Systems; Computer Information Systems; Design, Multimedia, and Web Technologies; and Digital Input Technologies.</p> <p><u>JOB SHADOWING</u> Job shadowing is a short-term, career-exploration form of worksite experience in which the student “shadows” (follows) a competent worker for a brief period of time. Job shadowing usually is the first form of worksite assignment given to students and is less intensive than mentoring, internship, and service learning</p> <p><u>MENTORING</u> Mentoring is a relationship between an experienced person (the mentor) and a less experienced person, such as a student (the mentee), in which the mentor provides guidance, support, feedback and skill instruction to the mentee. School-coordinated mentoring is more complex than job shadowing but tends to be less demanding and possibly shorter in duration than an internship or service learning.</p> <p><u>INTERNSHIP</u> An internship is a planned, progressive, structured educational activity or program that enables students to practice and develop career-related skills in a real workplace environment. An internship is more complex than job shadowing and mentoring when they are offered as separate programs.</p> <p><u>SERVICE LEARNING</u> Service learning is a community-based form of the work-based learning experience in which students and teachers cooperate with their locality to address problems and issues by applying knowledge and skills from several courses or from a total program.</p>

**Attachment B:
Budget Template**

**Virginia's Proposal to the National Governors Association
Science, Technology, Engineering and Math Center Grant Program
TWO-YEAR BUDGET**

	PROJECT BUDGET					MATCHING		
	Ex. Standards Development	Ex. Standards Implementation	Academy Planning	Academy Implementation	Total	Academy Planning	Academy Implementation	Total
PERSONNEL								
Salary - Project Director	24,800	24,800	37,200	37,200	124,000			
Fringe Benefits	9,285	9,285	13,928	13,928	46,426			
Indirect Cost	<u>1,000</u>	<u>1,000</u>	<u>1,500</u>	<u>1,500</u>	<u>5,000</u>			
Total Personnel	35,085	35,085	52,628	52,628	175,426			
CONSULTANT					-			
TRAVEL	2,000	1,500	2,000	2,000	7,500			
MEETING EXPENSES	2,000	3,000	2,000	3,000	10,000			
SUPPLIES	3,000	10,000	4,000	10,000	27,000			
OTHER EXPENSES:					-			
Grants to local/regional consortia		60,000	20,000	200,000	280,000	100,000	400,000	500,000
<u>Academy add-on funding</u>	<u></u>	<u></u>	<u></u>	<u></u>	<u>-</u>	<u></u>	<u>TBD</u>	<u>TBD</u>
<u>TOTAL REQUEST</u>	<u>42,085</u>	<u>109,585</u>	<u>80,628</u>	<u>267,628</u>	<u>499,926</u>	<u>100,000</u>	<u>400,000</u>	<u>500,000</u>

State funds that will support the goals of this initiative over and above the required match:

CTE Equipment	4,600,000	4,600,000
Industry Certification Support	<u>2,130,066</u>	<u>2,130,066</u>
	6,730,066	6,730,066

Federal funding for secondary and postsecondary Perkins activities will likewise support project goals.

Attachment C

Reinvigorating Career and Technical Education in Virginia: Governor's Exemplary Standards Awards and Governor's Academies for Career and Technical Education

PROPOSED PROGRAM DESCRIPTION

Career academies are targeted learning communities offering students a college-preparatory curriculum with a career orientation, and employing partnerships with businesses, communities and higher education. Research studies¹ that have been conducted on career academies over the past decade reported the following positive results:

- Reduced dropout rate and increased number of students graduating on time
- Raised high school achievement
- Decreased need for English remediation in college
- Increased probability of college graduation
- Increased academic course-taking
- Improved attendance

Virginia proposes to reinvigorate career and technical education in the commonwealth through a network of model career academies and high-level recognition for programs that meet rigorous academic and programmatic standards and produce positive results.

Mission

To provide expanded educational opportunities for secondary students to gain the knowledge, skills and credentials that will prepare them for high-demand, high wage and high skill careers in the competitive global economy of the 21st Century, through a partnership of business and industry, public schools, community colleges and government.

Goal #1: To maximize opportunities to prepare students for targeted careers, by breaking down barriers between traditional core academics and career and technical education; between high school and postsecondary education and training; and between education and the workplace.

¹ Longitudinal study by Manpower Demonstration Research Corporation based in New York and California;

Maxwell and Rubin (1997) "The Relative Impact of a Career Academy on Postsecondary Work and Education Skills in Urban, Public Schools;"

Kemple and Rock (1996) "Career Academies: Early Implementation Lessons from a 10-Site Evaluation;"

Kemple and Snipes (2000) "Career Academies: Impacts on Students' Engagement and Performance in High School."

Specific Measurable Objectives

- 1A. Improve academic achievement of CTE students.
- 1B. Increase utilization of dual enrollment and articulated courses.
- 1C. Provide workplace experiences for students through strong partnerships with businesses.

Goal #2: To raise student aspirations, attracting more students to postsecondary education in preparation for technical careers. Especially targeting students who might otherwise have settled for a curriculum that did not prepare them well for postsecondary education or work.

Specific Measurable Objectives

- 2A. Increase high school graduation rates and reduce drop-out rates.
- 2B. Increase enrollment and retention in postsecondary education.
- 2C. Increase proportion of students completing a college and workplace ready curriculum in high school.
- 2D. Reduce the proportion of students requiring remediation in college.

Goal #3: To provide well trained workers to support the recruitment of new businesses and industries to the Commonwealth and to meet the workforce needs of existing business and industry.

Specific Measurable Objectives

- 3A. Increase number of industry certifications awarded to high school students.
- 3B. Increase the number of graduates employed in high wage, high demand and high skill careers.
- 3B. (Long-term) Increase enrollment in and completion of targeted career pathways at community colleges and senior colleges.

Strategies

- 1) Create Governor's Exemplary Standards Awards as an incentive and recognition program for career and technical education programs to meet high standards for curriculum and outcomes.
- 2) Create a network of Governor's Academies for Career and Technical Education to serve as model programs for preparation of a 21st Century workforce.

Positioning of Programs

Academies

Academies will be positioned as moderately selective, prestigious educational venues geared to motivated students with interest in specialized careers. Student interns and

graduates will be sought-after by employers in the region for their specialized training and postsecondary/workplace readiness.

A statewide network of regional or metropolitan area Academies is envisioned in the long term. Academies will be defined by program content, not by the location or delivery system of courses. Courses may be delivered on a high school, technical center or community college campus, online, or in other innovative ways. Programs may be full-day or part-day, and academic-year, summer or combination thereof.

Approval of the Governor's Academy designation will be by the Virginia Board of Education, based on recommendations from regional and local industry, workforce and economic development officials and an application process parallel to that for Governor's Schools. Academies may be joint schools serving more than one jurisdiction.

Priority will be given to proposals with innovative approaches, such as multi-disciplinary, technology-enriched curriculum; team-based, problem-based learning through modularized (thus replicable) curriculum designed with industry participation; collaboration of mathematics and science teachers and CTE teachers to enrich the science and math content of CTE courses; P-16 integration including curriculum adaptation and development by vertical teams of high school, college and university faculty; inclusion of college faculty among the adjunct faculty of Academies; and professional development of faculty and administrators that goes beyond traditional school-based models.

All academies will be partnerships of business and industry, secondary schools, community colleges and where applicable universities, and workforce and economic development officials. Business partnership development will include business and industry advisory councils for each career and technical program area offered. To the greatest extent possible, these councils will come from existing regional industry advisory boards convened under the auspices of the regional workforce investment boards, community college workforce offices and Perkins/Tech Prep/Career Pathways leadership teams convened by colleges and schools. This approach will reduce duplication of effort and promote coordination of industry feedback to education and training programs at the secondary and postsecondary levels.

Academies will reflect a dual focus:

- 1) Meeting immediate regional needs: focus on high-demand, high-wage skill-intensive careers and industries in the region, as determined in consultation with major regional employers.
- 2) Meeting longer-term strategic needs: focus on careers and industries targeted for growth and expansion for the region and the commonwealth, particularly in technology and engineering fields that drive innovation.

(See additional information on required career pathways under Program of Study.)

Exemplary Standard Awards

All Academies will participate in the Governor's Exemplary Standards Program. This is a criterion referenced process that involves the faculty and higher education and business partners in examining the curriculum and outcomes to ensure continuous improvement of the quality of individual CTE programs. Programs will assemble the following evidence to demonstrate program quality, significance, and effectiveness, to be validated by external partners from industry and postsecondary education. (This outline and a much more detailed evaluation rubric are based on national research, and will be refined by a collaborative team of K-12, postsecondary, business, workforce and economic development representatives for Virginia's program.)

NDCCTE Standard	CTE Performance Indicators
Program Quality	<ul style="list-style-type: none"> • Program description, mission, vision, course expectations, competency lists, curriculum, and industry trends • Work stations, equipment inventory, safety compliance, work-based learning, and differentiated instruction • Curriculum that supports Virginia Standards of Learning, national standards, industry certifications, Virginia's Workplace Readiness Skills, and work-based learning • Industry partner involvement, articulation with higher education, and teacher collaboration
Educational Significance	<ul style="list-style-type: none"> • Support of workforce development, community service projects, and student employment • CTE completer options, career pathways, and teacher professional leadership roles • Teacher professional development activities, teachers' professional goals, industry innovations
Evidence of Effectiveness and Success	<ul style="list-style-type: none"> • CTE student data, CTE student success stories, CTE student organizations, record keeping of student competencies • Program data and recruitment of non-traditional students • Program trend analysis, program challenges, and best practices in program

Once the program has been in place for several years, Academies will have to meet Governor's Exemplary Standards for a minimum number of CTE programs in order to retain their status as Governor's Academies.

In addition, other regional and local career and technical education programs will be encouraged to participate in the Exemplary Standards program to raise the bar for their CTE programs. These awards will serve as external validation of the quality of CTE programs, based on standards developed through national research and adopted by the commonwealth. Significant business and higher education collaboration and validation is required to qualify for an award.

A statewide network of programs earning the Governor's Exemplary Standards Award will be established to share best practices and provide mentorship and technical assistance to other CTE programs.

Program of Study

The program of study in Governor's Academies will ensure that graduates complete a college and work readiness curriculum, minimally at the level specified for Commonwealth Scholars Course of Study (State Scholars Core), with the possibility of pre-approved substitution of equivalent courses where there may be more relevant course selections for a particular career pathway.

Programs will incorporate rigorous academic content with career and technical instruction. Programs will be designed (or later adapted) to ensure that graduates will qualify for the new Technical or Advanced Technical Diplomas to be developed by the Board of Education. In addition, all graduates should achieve one or more of the following benchmarks:

- Earn an Associate Degree
- Earn one or more industry certifications or state occupational licenses, and/or demonstrate competencies on an assessment instrument recognized by postsecondary institutions such as CLEP examinations, collaboratively designed or mutually approved end-of-course tests, college placement tests, or student portfolios reviewed by a team of college and high school faculty.
- Earn at least 9 transferable college credits as defined in the Early College Scholars program (includes dual enrollment, Advanced Placement and other options)

All programs will offer at least three well-articulated career pathways that include opportunities to earn postsecondary certificate, diploma or associate degrees while in high school and pursue additional industry credentials and academic degrees at the associate, bachelors and graduate levels (4+2 and 4+2+2 pathways at minimum.)

At least one career pathway must be in a field targeted for development by state policy-makers, to be further specified in program guidelines. For reference, the Virginia Economic Development Partnership has targeted the STEM-related fields of aerospace, automotive technology, biosciences and electronics for business development, as well as financial services, food processing, distribution, motorsports and plastics. Virginia's Research and Technology Advisory Commission has targeted research and development in energy, life science and semiconductors, using methods from modeling & simulation and nanotechnology.

At least one career pathway must be in a high wage, high skill and high demand field as identified by regional and local employers and workforce officials.

Programs will incorporate Virginia's Workplace Readiness Skills² and offer opportunities for students to earn Virginia and National Career Readiness Certificates. All programs will include significant work-based experience for students, ranging from job shadowing to full apprenticeship.

Academic-year programs will include a summer component between the junior and senior years, which may be a summer internship, additional instruction, project-based learning, or a combination of these.

Admission/Selection of Students

Preparation for entering the Academies should begin by eighth grade with completion of career interest inventories and academic and career plans outlining an intended course of study in high school. At that time curriculum plans should be established with the goal of ensuring that all students retain options for multiple postsecondary pathways. Career assessments should be used to identify areas students should strengthen to qualify for their selected pathways. The available diplomas, seals and other recognition should be discussed, as well as the requirements for admission to specialized programs including Governor's Academies. By encouraging students to complete at minimum the Commonwealth Scholars Course of Study, advisors can help to ensure that students will qualify for the specialty programs of their choice.

Admission to the Academies will be based on a number of factors including those listed below. Local school divisions and regional consortia may set additional criteria. In addition, where programs include dual enrollment in a postsecondary institution, the institution's policies and admissions requirements for dual enrollment students will apply.

- Completed Academy application signed by the student and parent/guardian, including personal statement regarding interest in and commitment to program
- Letters of recommendation from teachers
- School attendance record
- Evidence of student potential and work ethic, which may be included in teacher recommendations and student personal statement

² Virginia's 13 Workplace Readiness Skills are:

1. Demonstrate reading skills on a level required for employment in a chosen career field.
2. Demonstrate math skills on a level required for employment in a chosen career field.
3. Demonstrate writing skills on a level required for employment in a chosen career field.
4. Demonstrate speaking and listening skills on a level required for employment in a chosen career field.
5. Demonstrate computer literacy on a level required for employment in a chosen career field.
6. Demonstrate reasoning, problem-solving, and decision-making skills.
7. Demonstrate understanding of the "big picture."
8. Demonstrate a strong work ethic.
9. Demonstrate a positive attitude.
10. Demonstrate independence and initiative.
11. Demonstrate self-presentation skills.
12. Maintain satisfactory attendance.
13. Participate as a team member to accomplish goals.

For additional information see: <http://www.cterresource.org/publications/featured/wpr/index.html>

- Attainment of junior status, on track to graduate on time with a Commonwealth Scholars designation at minimum
- Grade point average of 2.5 or greater

Teacher Qualifications

Academies will employ highly qualified teachers with industry-specific education, training and experience, including industry certification and prior employment in the field of instruction. Where applicable, teachers without industry certification will be expected to be working toward such credentials. All teachers will use professional development opportunities, continuing education and contact with industry partners to remain current in their field.

Process for Designation as Governor's Academy *(conditional on adoption by Board of Education)*

The following process, based on the Procedures for Initiating an Academic-Year Governor's School, is proposed for Board of Education designation of Governor's Academies for Career and Technical Education.

Planning grants will be awarded on a competitive basis at the beginning of the 2007-08 academic year for six Academy Planning Committees comprising superintendents, community college personnel, major employers and workforce and economic development officials in a region. Awards will be based on the responsiveness of the application to the goals, objectives and criteria presented above. Specific instructions and criteria for planning grant applications will be developed by the statewide planning group. Implementation of the first Academies is targeted for the 2008-09 academic year.

The procedure for requesting Board of Education designation as a Governor's Academy for Technical Education includes the following steps:

1. School divisions desiring to implement a Governor's Academy shall provide the Department of Education with documentation of the following:
 - ◆ The existence of an active, on-going **Academy Planning Committee** of superintendents or their designees from the participating school divisions. The committee should also include regional employers, school board members, current and/or recent CTE students, and parents. The planning committee shall design an Academy program and determine the location and fiscal agent.
 - ◆ A statement which demonstrates the need/rationale for the Academy. This statement should be concise and state the important reasons to have a Governor's Academy, separate and unique from the existing program offerings for secondary students.

- ◆ A brief description of the proposed program, including site location, number of students, grade levels, and general curriculum design.
 - ◆ A written memorandum of agreement with local businesses, industries, and community colleges. This agreement will suggest ways in which community resources will contribute to the Governor's Academy to broaden the scope of the students' educational experiences.
 - ◆ A statement of assurance that the Governor's Academy Planning Committee has reviewed provisions of the Administrative Procedures Guide for the Establishment of Governor's Academies for Career and Technical Education and agrees to follow the guidelines set forth in the document.
 - ◆ A statement of assurance that an on-going Advisory Council or Governing Board will be established that includes educators, business leaders, higher education representatives and community members.
 - ◆ A statement of assurance that all divisions listed in the proposal, at the time it is approved by the Board of Education, intend to participate for a minimum of three years in the program.
2. The Department of Education will review the proposal and documentation and make a report to the Board of Education with a recommendation.
 3. The Board of Education will determine if the proposed program is approved as a joint school (Section 22.1-26 of the Code of Virginia) if applicable, and is to be recommended to the Governor to be designated, with appropriate funding, as a Governor's Academy.
 4. The Department of Education may issue a contract involving the fiscal agent, the Governing Board, and the Department of Education.
 5. The Department of Education will assist the planning committee in developing the Administrative Procedures and will evaluate the program on a regular basis.

Attachment D: Letters from Virginia's Project Team Members

1. Dr. Thomas R. Morris
Secretary of Education
2. Mr. Patrick O. Gottschalk
Secretary of Commerce and Trade
3. Mr. Daniel G. LeBlanc
Senior Advisor to the Governor for Workforce
4. Dr. Billy K. Cannaday, Jr.
Superintendent of Public Instruction
5. Dr. Daniel J. LaVista
Executive Director, State Council of Higher Education for Virginia
6. Dr. Glenn DuBois
Chancellor, Virginia Community College System
7. Dr. Patrick Konopnicki
Director of Technical & Career Education, Virginia Beach Schools
8. Mr. Darah Bonham
Director, Charlottesville-Albemarle Technical Education Center (regional)
9. Ms. Sandy Jones
President, Virginia Association for Career and Technical Education
10. Mr. John O. (Dubby) Wynne
Vice-Chairman, Council for Virginia's Future, and
retired President and CEO and current Board member, Landmark Communications, Inc.
11. Ms. Katherine Elam Busser
Senior Vice President, Capital One
12. Dr. James G. Batterson
Senior Aerospace Engineer and Deputy Director for Strategic Development
NASA Langley Research Center and Special Assistant on Loan to the Secretary of Education
(Letter from Richard Antcliff, Director of Advanced Planning and Partnership Office)
13. Dr. Emily Richardson
President, Virginia Career Education Foundation
14. The Honorable Phillip Hamilton
Member, Virginia House of Delegates, and House Education and Appropriations Committees
15. The Honorable Frank Wagner
Member, Senate of Virginia and Senate Commerce and Labor Committee
16. The Honorable John A. Cosgrove
Member, Virginia House of Delegates and House Science and Technology Committee, and
Chairman, Joint Subcommittee Studying Science, Math, and Technology Education in the
Commonwealth at the elementary, secondary, and undergraduate levels



COMMONWEALTH of VIRGINIA

Office of the Governor

Thomas R. Morris
Secretary of Education

May 14, 2007

Cardella Mingo
National Governor's Association
Center for Best Practices
444 North Capitol Street, Suite 267
Washington, DC 20001-1512

Dear Ms. Mingo,

I am pleased to serve as the team leader for Virginia's Science, Technology, Engineering and Math Center grant project. As you will see in the enclosed application, we have assembled an excellent team with the top leadership and leading experts in state education policy from the Governor's Office, public education, higher education including community colleges, business and industry, the legislature, and career and technical education programs.

We have what I believe is an original and very promising approach to strengthen our innovation economy through career and technical education. This approach was developed in consultation with our team members and a host of additional partners throughout the state. We have been working together to improve the quality of Virginia's workforce and address shortages in a range of skills, including technical skills and those falling under the umbrella of 21st Century skills.

This project comes at a propitious time for Virginia. One might say the stars are aligned in the commonwealth for reinvigorating career and technical education as a rigorous and challenging pathway for all students. Our Governor has made CTE one of his educational priorities. There is enthusiastic interest in the General Assembly for efforts to enhance CTE, as evidenced by recent legislation and budget initiatives that have received strong bipartisan support. And our CTE community is poised to reach higher, embracing the Governor's call to move beyond competence to excellence.

Thank you for your consideration of our proposal, and we look forward to hearing from you.

Sincerely,

A handwritten signature in black ink that reads "Tom Morris".

Thomas R. Morris
Secretary of Education



COMMONWEALTH of VIRGINIA

Office of the Governor

Patrick O. Gottschalk
Secretary of Commerce and Trade

May 7, 2007

The Honorable Thomas R. Morris
Secretary of Education
Commonwealth of Virginia
Patrick Henry Building
1111 East Broad Street
Richmond, VA 23219

Dear Secretary Morris:

I am pleased to endorse Virginia's application for a National Governor's Association Science, Technical, Engineering and Math (STEM) Center Grant. This is a timely opportunity for Virginia to reinvigorate career and technical education (CTE). CTE is essential for preparing students for high-demand, high-skill, high-wage careers in the competitive global economy of the 21st Century. However, we have much work ahead of us to raise the rigor and status of CTE in Virginia. The approaches proposed through this project hold great promise.

When Governor Kaine and I meet with business leaders who are considering locating or expanding in Virginia, their top priority is finding this skilled workforce they need to compete. The STEM proposal is an important component in our efforts to ensure Virginia's future economic growth and stability in an increasingly technologically driven market. Thank you for including me in this effort.

Sincerely,

A handwritten signature in blue ink, appearing to read "Patrick O. Gottschalk", with a large, loopy flourish extending from the end of the signature.

Patrick O. Gottschalk

POG:cbe



COMMONWEALTH of VIRGINIA

DEPARTMENT OF EDUCATION

P.O. Box 2120
Richmond, Virginia 23218-2120

BILLY K. CANNADAY, JR., Ed.D.
Superintendent of Public Instruction

Office: (804) 225-2023
Fax: (804) 371-2099

May 14, 2007

The Honorable Thomas R. Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, Virginia 23219

Dear Secretary Morris:

The Commonwealth of Virginia's proposal to the National Governors Association (NGA) STEM Center Grant Program was written as an opportunity to develop core academic and other 21st Century skills in the general student population. As noted in the proposal, Virginia has done a good job of producing and attracting college-educated scientists, engineers and other knowledge workers. However, reports from postsecondary educators and employers indicate that our students continue to lack key skills and abilities needed for the work place. This proposal identifies career and technical education as a promising venue for developing the missing critical skills through applied learning.

Virginia has demonstrated its ability to support statewide grant work through its conscientious administration of the NGA Grant to Redesign the American High School. From those grant activities, we have learned much about the importance of effective transitions from middle to high school and from high school to college. This work has influenced the work of the Department of Education and the Board of Education in considering policies related to graduation and dropouts, literacy for adolescents, and college equity and access. If we were to receive the STEM grant, our educational teams would make every effort to administer it in a responsible manner, such that the work would broaden and enhance our previous NGA work.

I ask that you give Virginia's grant proposal serious consideration. Please feel free to contact me at (804) 225-2023 if you have any questions about Virginia's proposal.

Sincerely,

A handwritten signature in cursive script, reading "Billy K. Cannaday, Jr.", written in dark ink.

Billy K. Cannaday, Jr.

BKCr/jm



COMMONWEALTH of VIRGINIA
Office of the Governor



Daniel G. LeBlanc
Senior Advisor for Workforce

May 7, 2007

The Honorable Dr. Thomas R. Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, VA 23219

Dear Secretary Morris,

As the Senior Advisor to the Governor for Workforce, I am pleased to endorse Virginia's application for a National Governor's Association STEM Center Grant. This is a timely opportunity for Virginia to engage in meaningful work to reinvigorate career and technical education (CTE). CTE is an important route for preparing students for high-demand, high-skill, high-wage careers in the competitive global economy of the 21st Century. However, we have much work ahead of us to raise the rigor and status of CTE in Virginia. The approaches proposed through this project hold great promise.

One of the goals in Governor Kaine's Workforce Development Strategic Plan addresses the need to respond to long-range talent and skill forecasts as well as emergent near-term market and business needs. Further, an action item in the Strategic Plan calls for every public school student to have an individualized high school plan to ensure course selection decisions are aligned with students' transition and career goals after high school by 2010. CTE is a vital component of this action item. We are very hopeful that Virginia will be selected for a National Governor's Association STEM Center grant.

Sincerely,

Daniel LeBlanc



COMMONWEALTH of VIRGINIA

Daniel J. LaVista
Executive Director

STATE COUNCIL OF HIGHER EDUCATION FOR VIRGINIA
James Monroe Building, 101 North Fourteenth Street, Richmond, VA 23219

(804) 225-2600
FAX (804) 225-2604
www.schev.edu

May 10, 2007

The Honorable Thomas R. Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, VA 23219

Dear Secretary Morris,

On behalf of the State Council of Higher Education for Virginia (SCHEV), I am pleased to endorse Virginia's application for a National Governors Association STEM Center Grant. This opportunity for Virginia to engage in meaningful work to reinvigorate career and technical education (CTE) is both timely and on target.

CTE is a critical component of preparing students for the high-skill, high-pay careers that are and will continue to be in high demand in the competitive global economy of the 21st Century. If educational opportunities for secondary students are to be expanded, and if the rigor and status of CTE in Virginia are to be raised, then much work lies ahead. Toward that end, I firmly believe that the approaches proposed through this project hold great promise.

This effort to develop CTE as an option for all students – with the same postsecondary pathways expectations for CTE students as for non-CTE students – is highly congruent with SCHEV's goals and priorities in that it will help to prepare more Virginia high school graduates for postsecondary education. Moreover, it is very compatible with the Restructuring Act's goal of increasing the access/participation, retention and graduation of Virginia residents, especially those from underrepresented groups such as first generation college-going and minority students.

As you know, SCHEV recently completed a new statewide strategic plan for higher education in the Commonwealth. Our process involved an active and engaged advisory committee of representatives from education, state government (elected and appointed) and the private sector. From this experience, I am confident in my expectation that the partnership you envision between business/industry, secondary education and community colleges will be equally as strong and fruitful. I am certain that many highly capable people in the Virginia Department of Education and the Virginia Community College System stand ready to move this effort forward.

My staff and I also stand ready to do whatever is necessary to assist in reinvigorating CTE in Virginia. Please keep me informed of the application's status as it progresses through the NGA review process.

Sincerely,

A handwritten signature in blue ink, appearing to read "Daniel J. LaVista".

Daniel J. LaVista, Ph.D.



VIRGINIA COMMUNITY COLLEGE SYSTEM

James Monroe Building • 101 North Fourteenth Street • Richmond, Virginia 23219

May 10, 2007

The Honorable Thomas R. Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, VA 23219

Dear Secretary Morris,

On behalf of Virginia's community colleges, I am pleased to endorse Virginia's application for a National Governor's Association STEM Center Grant. This is a timely opportunity for Virginia to engage in meaningful work to reinvigorate career and technical education (CTE). CTE is an important route for preparing students for high-demand, high-skill, high-wage careers in the competitive global economy of the 21st Century. However, we have much work ahead of us to raise the rigor and status of CTE in Virginia. The approaches proposed through this project hold great promise.

Virginia's community colleges are committed to continuing our work with secondary schools throughout the Commonwealth to develop new and innovative ways to more effectively deliver career and technical education. We are particularly interested in implementing the concept of a Governor's academy for CTE on community college campuses. The combined resources of the community college and secondary schools in the form of faculty expertise, relationships with business and industry, cutting edge curriculum, equipment, and lab facilities will result in a more effective delivery system for CTE and a more productive pipeline of skilled workers for the Commonwealth.

Thank you again for your leadership in moving this effort forward.

Sincerely,

A handwritten signature in black ink, appearing to read 'Glenn DuBois', is written over a light blue horizontal line.

Glenn DuBois
Chancellor

GD/ph



VIRGINIA BEACH CITY PUBLIC SCHOOLS

AHEAD OF THE CURVE

May 8, 2007

Dr. Thomas R. Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, VA 23219

Dear Secretary Morris,

As CTE director of the state's second largest school system, I am pleased to endorse Virginia's application for a National Governor's Association STEM Center Grant. This is a timely opportunity for Virginia to engage in meaningful work to reinvigorate career and technical education (CTE). CTE is an important route for preparing students for high-demand, high-skill, high-wage careers in the competitive global economy of the 21st Century. Part of the focus of this project is to increase the visibility of CTE programs that are considered highly successful by practitioners—namely, “exemplary”—and to use interactive dissemination strategies to get vital information to practitioners who are interested in replicating and benchmarking exemplary CTE programs.

The processes used in this project, based on the criteria used in the former Exemplary and Promising Programs project of the National Dissemination Center for Career and Technical Education, can both drive program improvement and provide leadership strategies for school reform that will positively impact student achievement. The Governor's CTE Academies using a similar “Exemplary Standards” criteria will not only help recognize but also stimulate exemplary CTE programs around the commonwealth.

We look forward to working with our state partners to build successful programs that highlight exemplary teachers and students. We share the goals of increasing the technical literacy, high tech skills, and career awareness of those students included in this STEM proposal, as this is critical to the Virginia Beach workforce.

At the same time our community stakeholders will become more aware of the rigorous CTE educational content as well as career opportunities offered by real-world exemplary programs. I am hopeful that the National Governors' Association will make the funding available to advance this project.

Sincerely,

Patrick Konopnicki Ed.D.
Director of Technical and Career Education

/t

May 10, 2007

Dr. Thomas R. Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, VA 23219

Dear Secretary Morris:

As the Director for the Regional Career and Technical Center in Charlottesville, I was very excited to hear the idea regarding Virginia's application for a National Governor's Association STEM Center Grant. We have been looking for opportunities like this to enhance the educational experience of students in CTE programs. Without question, the mastery of transferable, essential skills for our students is critical as we prepare a workforce for opportunities in the 21st century. Businesses and industry leaders are at a critical juncture with the shortage of qualified employees, and the Governor's initiative provides a refocus on the instructional programs and strategies we implement as a school system and as part of CTE. Raising the bar for student achievement, through the creation of a reputable vehicle for delivery of instruction, will better prepare students for success in an ever-changing global economy.

Regards,
Darah Bonham

Darah Bonham

Director
Charlottesville Albemarle Technical Education Center



**Virginia Association of Career and Technical Education
7423 Camp Alger Avenue
Falls Church, Virginia 22042**

Sandra R. Jones
President

May 9, 2007

John Ledgerwood
Vice President

Brenda D. Long
Vice President

Kim Thomas
Vice President

Beth Downey
Secretary

Judy Sams
Treasurer

Ken Anderson
President-Elect

Barbara Simmons
Past President

George R. Willcox
DOE Representative

Roger Johnson
ACTE Region II
Representative

Dr. Thomas Morris
Secretary of Education
Commonwealth of Virginia
Patrick Henry Building, 4th Floor
1111 East Broad Street
Richmond, VA 23219

Dear Dr. Morris:

On behalf of the Virginia Association for Career and Technical Education (VACTE) I am pleased to endorse Virginia's application for a National Governor's Association STEM Center Grant. This is a timely opportunity for Virginia to engage in meaningful work to reinvigorate career and technical education (CTE). CTE is an important route for preparing students for high-demand, high-skill, and high-wage careers in the competitive global economy of the 21st Century. However, we have much work ahead of us to raise the rigor and status of CTE in Virginia. The approaches proposed through this project hold great promise.

Sincerely,

A handwritten signature in cursive script that reads "Sandra R. Jones".

Sandra R. Jones
President

JOHN O. WYNNE

ONE COMMERCIAL PLACE, SUITE 1420
NORFOLK, VIRGINIA 23510
TELEPHONE: (757) 446-2007
FAX: (757) 228-1106
e-mail: jowynne@jgwinc.com

May 11, 2007

Thomas R. Morris
Secretary of Education
Commonwealth of Virginia
Patrick Henry Building, 4th Floor
1111 E. Broad Street
Richmond, Virginia 23219

Dear Secretary Morris:

I am pleased to lend my support and expertise to Virginia's effort to reinvigorate career and technical education. In my roles as business leader and vice-chair of the Council on Virginia's Future, I am keenly aware of the importance of this effort to Virginia's continued prosperity.

In December 2005 our Council co-sponsored the first Virginia Futures Forum, with the theme of *Competing in the 21st Century: Moving Virginia's Human Capital Meter*. The participants in the forum identified three policy approaches to develop human capital for the future economy. One of these approaches is to improve Virginia's K-12 educational system to ensure adequate preparation for continued education or employment. This includes creating a new model for K-12 education with rigorous academic and applied skills standards and increased career preparation curricula in K-12, including Career Development Plans and local connections among businesses and schools.

The current proposal to create high standards for career education and reward programs that reach them, and to establish career academies that involve regional business and higher education partners, directly responds to the recommended approach. I am happy to assist this effort in any way I can.

Sincerely,


John O. Wynne

JOW/jsr

JOHN O. WYNNE

John O. Wynne is the retired President and Chief Executive Officer of Landmark Communications, Inc., which has interests in newspapers, broadcasting, cable programming and electronic publishing. Mr. Wynne is a member of the Board of Directors of Landmark.

Mr. Wynne is a Member, Board of Visitors, University of Virginia; Chairman of the Special Committee on Planning of the Board of Visitors; Chairman of the Board, University of Virginia Investment Management Company; a Charter Trustee and member of the Executive Committee of the Board of Trustees, Princeton University; Chairman of the Academic Affairs Committee of the Board at Princeton; Member of the Board of Trustees, Colonial Williamsburg Foundation; Board Member and Treasurer of The Norfolk Foundation; Member and former Co-Chairman, Hampton Roads Partnership. He served on the Governor's Commission on Efficiency and Effectiveness in 2002 – 2003, and now serves as Vice Chairman on the State appointed Council on Virginia's Future. In 2006, Wynne received a Distinguished Service Award from the National Governor's Association for his work in creating and then helping to implement the Council on Virginia's Future, which focuses on developing a long-range strategy and performance management system for the Commonwealth of Virginia.

He is the Past Chairman of the Board of the Virginia Business Council; former Board Member and member, Executive Committee, University of Virginia Alumni Association; former Trustee and member, Executive Committee of Virginia Foundation for Independent Colleges; former Trustee and President, Board of Trustees, Norfolk Academy; former Director and Member, Executive Committee, National Cable Television Association; former Chair, National Satellite Programmers Group; former Member of the state-appointed State Council of Higher Education of Virginia; former Member and Vice-Chair, Children's Hospital of the King's Daughters; former Chair, United Way of South Hampton Roads Capital Campaign; former Director and President, Junior Achievement of Tidewater; and former Co-Chair of Leadership Giving for Princeton's \$1.1 billion Anniversary Campaign.

Mr. Wynne received his BA from Princeton University in 1967 and JD from the University of Virginia in 1971. Prior to joining Landmark Communications, Mr. Wynne was an attorney

with the firm of Willcox, Savage, Lawrence, Dickson & Spindle in Norfolk. He is married to the former Susan Snodgrass. They live in Virginia Beach and have two living children.

April 2007



Capital One Services, Inc.
15000 Capital One Drive
Richmond, VA 23238

May 9, 2007

Dr. Thomas R. Morris
Secretary of Education
Commonwealth of Virginia
Patrick Henry Building, 4th Floor
1111 E. Broad Street
Richmond, VA, 23219

I am pleased to endorse Virginia's application for a National Governor's Association Science, Technology Engineering and Math (STEM) Center Grant. This is a timely opportunity for Virginia to engage in meaningful work to reinvigorate career and technical education in the state. This is an important route for preparing students for high-demand, high-skill, high-wage careers in the competitive global economy of the 21st Century and the approaches proposed through this project hold great promise.

As an executive at one of Virginia's major financial services employers, I can tell you first-hand that the business community understands that Virginia needs a balanced, healthy economy for our businesses to thrive. The proposed effort to raise the standards for career and technical education and its alignment with regional economic needs will help provide Virginia's companies with a supply of qualified skilled employees for high-demand and high-wage jobs. These programs will also prepare our students, offering a variety of degrees and educational experiences, and allowing them to tackle the future challenges in our business and economy.

The financial services sector certainly depends on an educated workforce and all of Virginia benefits from a well-employed citizenry. Sustaining a workforce, which can compete in a global economy, requires new investments and I am delighted to support Virginia's pursuit of these programs.

Thank you for your consideration.

Sincerely,

A handwritten signature in black ink, reading "Katherine E. Busser". The signature is fluid and cursive, with the first letters of each word being capitalized and prominent.

Katherine E. Busser
Executive Vice President, Capital One

National Aeronautics and
Space Administration

Langley Research Center
100 NASA Road
Hampton, VA 23681-2199



May 14, 2007

Reply to Attn. of: 218

The Honorable Thomas R. Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, VA 23219

Dear Secretary Morris:

I am pleased to endorse Virginia's application for a National Governor's Association STEM Center Grant. As you know, we have already supported the development of the proposal through the detailing of James G. Batterson of my organization to your office where he has served as a member of the proposal team. NASA has the development of STEM educated future workforce as one component of its Agency Strategic Plan. At NASA's Langley Research Center, we are reinvigorating an apprentice program for technicians and would expect that the increased quantity and quality of CTE students that would result from a successful NGA STEM Center proposal from Virginia would make that apprentice program even stronger.

NASA has been given a multi-generational challenge to replace Shuttle, return to the Moon, and explore Mars. These huge challenges will require all the 21st Century skills from traditional trades, to computer technologists, to engineers, and scientists. Again, I endorse your application and thank you for moving Virginia forward in this area of education that is so critical to our Agency's success.

Cordially,

Richard R. Antcliff

Richard R. Antcliff
Director, Advanced Planning & Partnership Office

2002 Bremono Road ■ Lower Level ■ Richmond, VA 23226 ■ 804-615-1505 phone ■ 757-229-4242 fax ■ vcef@cox.net

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Founder, Specialty Blades, Inc.

Sharon E. Pope

Parent

The Honorable

Kenneth R. Plum
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VP for Human Resources
Hospital Corp. of America
Capitol and Richmond Divisions

Dr. N. Wayne Tripp

Superintendent,
Salem Public Schools

The Honorable

Jack Ward
Hanover County
Board of Supervisors

May 7, 2007

Dr. Thomas R. Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, VA 23219

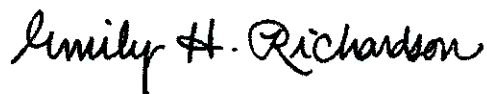
Dear Secretary Morris:

On behalf of the Board of Directors of the Virginia Career Education Foundation, I am pleased to endorse Virginia's application for a National Governor's Association STEM Center Grant. This is a timely opportunity for Virginia to engage in meaningful work to reinvigorate career and technical education (CTE). CTE is an important route for preparing students for high-demand, high-skill, high-wage careers in the competitive global economy of the 21st Century. However, we have much work ahead of us to raise the rigor and status of CTE in Virginia. The approaches proposed through this project hold great promise to address both challenges.

VCEF promotes CTE and the great career opportunities available in pathways entered through CTE in secondary school. Having Governor's Academies for Technical Education coupled with Governor's Exemplary Standard Awards will send a valuable message to help parents validate these career choices for their young adults.

The Foundation looks forward to partnering with you in these meaningful efforts. Let us know how we may assist.

Sincerely,



Emily H. Richardson, Ed.D
President

COMMONWEALTH OF VIRGINIA

HOUSE OF DELEGATES

RICHMOND

PHILLIP A. HAMILTON
Post Office Box 1585
Newport News, Virginia 23601

COMMITTEE ASSIGNMENTS:
Health, Welfare & Institutions (Chairman)
Education
Appropriations

NINETY-THIRD DISTRICT

May 8, 2007

Dr. Thomas R. Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, VA 23219

Dear Secretary Morris:

I am pleased to endorse Virginia's application for a National Governor's Association STEM Center Grant. In Virginia, career and technical education is an area of critical need. It is an important aspect of preparing our students for the high-skill, high-wage careers of the 21st century.

In the General Assembly, I have been a champion of elevating career and technical education. We have growing bipartisan support in the legislature to expand, elevate, and enhance career and technical education.

This year, with overwhelming support from the other legislators, I carried legislation establishing the Technical Diploma, which will give students an opportunity to explore and excel in the career and technical fields. In the past, I sponsored legislation to create the state's Advisory Council for Career and Technical Education.

Despite growing support and recent successes, we have a lot of work to do to ensure that we are meeting the workforce demands of the 21st century. As a result, I enthusiastically support Governor Kaine in finding creative ways to promote career and technical education. The approaches in this proposal hold great promise for addressing changing workforce needs and for giving students opportunities to be successful throughout schooling and in life.

Sincerely,

Phillip Hamilton

Phillip Hamilton

SENATE OF VIRGINIA

FRANK W. WAGNER
1st SENATORIAL DISTRICT
PART OF THE CITY OF VIRGINIA (EAST)
FIRST DISTRICT HOUSE
VIRGINIA BEACH, VIRGINIA 23461



COMMITTEE ASSIGNMENTS
COMMONS AND LANDS
GENERAL LAWS AND TECHNOLOGY
REHABILITATION AND SOCIAL SERVICES
TRANSPORTATION

May 10, 2007

Dr. Thomas R. Morris, Secretary
Virginia Department of Education
Patrick Henry Building
111 E. Broad St.
Richmond VA 23219

Dear Secretary Morris:

I write to endorse Virginia's application for a National Governors Association grant, available to states that are creating Centers for Science, Technology, Engineering and Math. As I understand it, the focus in Virginia will be on Career and Technical Education, patterning schools dedicated to CTE curricula on the current Governor's Schools network.

Career and Technical Education has long been a passion of mine. As a business owner with many employees in skilled trades, I have become painfully aware that as these workers reach retirement, there are no young people who are qualified to replace them. The young men and women entering the work force today do not possess the necessary skill sets because career and technical courses have been eliminated or portrayed as inferior to the college track curriculum. This does a grave disservice to those students who are interested in a skilled trade as a career and would do well, both in satisfaction and compensation, in that environment. As a legislator, I have pursued the reintroduction of CTE curricula in the Commonwealth's public schools and last session passed legislation that will create a new CTE diploma, which the Governor signed into law.

The technical demands of the 21st century dictate the development of a skilled workforce. This grant proposal is an important step in providing the next generation of students with the tools necessary to compete and succeed in the world of tomorrow. I will support any and all efforts to promote career and technical education in Virginia.

Kindest regards,

A handwritten signature in black ink that reads "Frank W. Wagner".

Frank W. Wagner



COMMONWEALTH OF VIRGINIA
HOUSE OF DELEGATES
RICHMOND

JOHN A. COSGROVE
POST OFFICE BOX 3483
RICHMOND, VIRGINIA 23219
REPRESENTATIVE DISTRICT

COMMITTEE ASSIGNMENTS:
PRIVILEGES AND ELECTIONS
TRANSPORTATION
SCIENCE AND TECHNOLOGY

May 13, 2007

Dr. Thomas Morris
Secretary of Education
Patrick Henry Building
1111 E. Broad Street
Richmond, Virginia 23219

Dear Secretary Morris:


It is my pleasure to add my endorsement of Virginia's Application for a National Governor's Association STEM Center Grant. We in the General Assembly are acutely aware of the critical need for the technical education of our Virginia students so that they will be adequately trained to seek high paying and important work in the technical fields. As a member of the Joint Commission of Technology and Science, I am reminded daily of the need for a technology education workforce that is so desperately needed in our Commonwealth.

I am the Chief Patron and chairman of the HJR 25 study that is currently investigating the way Virginia educates our children in Science, Technology, Engineering, and Math. This working group, made up of legislators and citizen experts in the STEM education field, recognizes the need for additional technology resources in Virginia as well as throughout the United States.

While we are working to enhance STEM education opportunities throughout the Commonwealth, I am confident that a grant for a STEM Center will help expedite the ability of our education system to provide the technical education that is so critically needed by our students. The ability of the private sector to expand and accelerate technology innovations is directly proportional to an educated workforce that is able to meet the demands of the employers who deal in technology industries.

Again, I heartily endorse the application for a National Governor's Association STEM Center Grant.

Sincerely,


John A. Cosgrove

Attachment E

Letter of Commitment for Matching Funds



COMMONWEALTH of VIRGINIA
Office of the Governor

Daniel G. LeBlanc
Senior Advisor for Workforce

May 11, 2007

The Honorable Thomas Morris
Secretary of Education
1111 East Broad Street, 4th floor
Richmond, VA 23219

Dear Secretary Morris:

As Chief Workforce Development Officer for the Commonwealth, I am pleased to provide the following confirmation of commitment for State-level Workforce Investment Act (WIA) funds should Virginia's request for participation in the National Governor's Association Academy for be approved.

Specifically, \$100,000 in state-level WIA funds will be made available as matching funds to support the career academies that will provide expanded educational opportunities for secondary students to gain the knowledge, skills and credentials that will prepare them for high-demand, high wage and high skill careers in the competitive global economy of the 21st Century, through a partnership of business and industry, public schools and community colleges. As you are aware, such collaborative initiatives between workforce development and education are wholly consistent with the goals and strategies of the Governor's Workforce Development Plan and I am pleased to offer this support.

Please let me know of any further assistance you may require.

Sincerely,

A handwritten signature in black ink, appearing to read "Denny".

Daniel G. LeBlanc

DGL/bd